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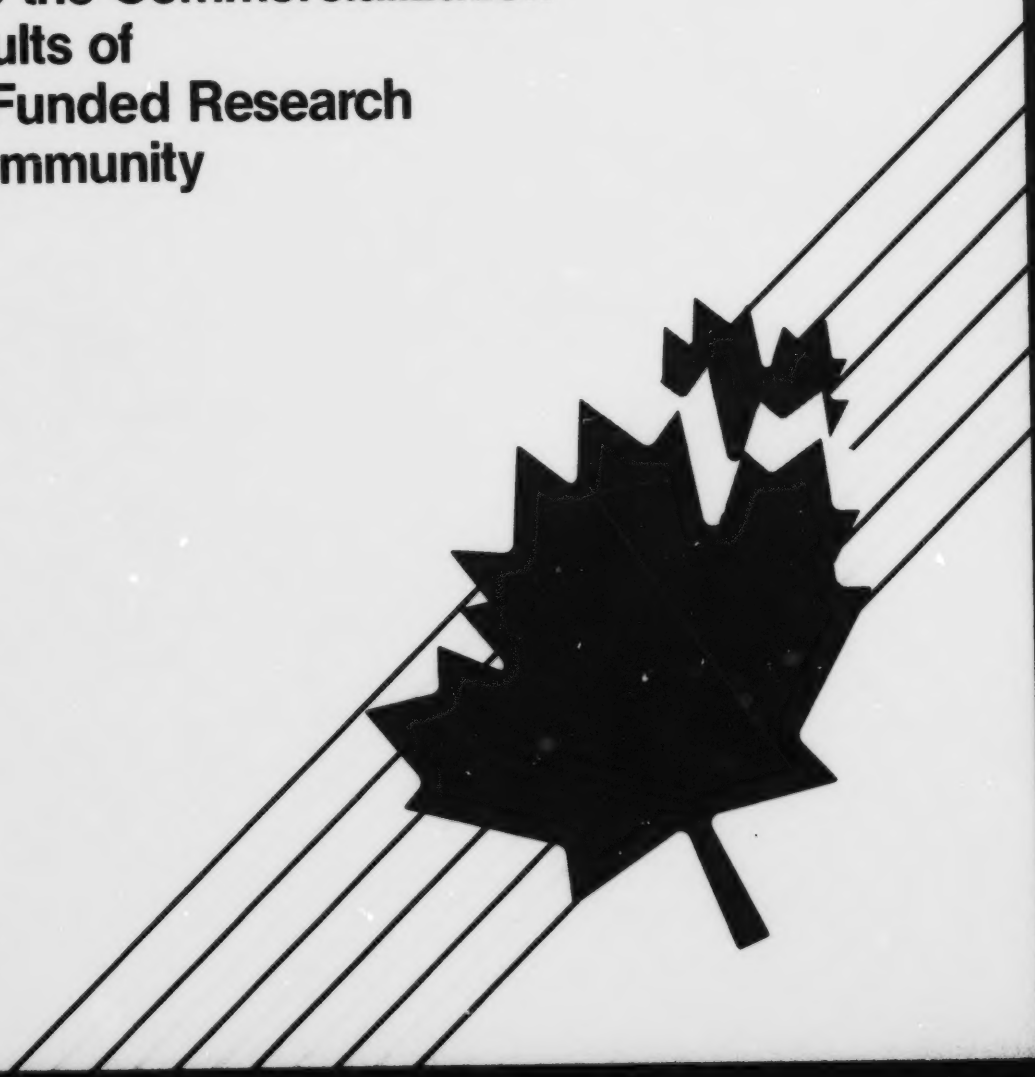
Technology Venturing in Canada

A Guide to the Commercialization of the Results of Federally Funded Research in Your Community



Canada

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TECHNOLOGY VENTURING IN CANADA

A GUIDE TO THE COMMERCIALIZATION OF THE RESULTS OF FEDERALLY FUNDED RESEARCH IN YOUR COMMUNITY

Prepared for

the
Ministry of State
for
Science and Technology

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A handbook for entrepreneurs, investors, economic development officers and others involved in the diffusion of technology from federally funded research.

- a guide to the federal research system
- a listing of federal research institutions by region
- techniques for accelerating the diffusion process
- tips on technology venturing at the community level

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This handbook is intended as an aid to local economic development agencies and others who might become involved in the process of technology diffusion from federal laboratories. It provides a listing of such facilities by geographic area and a brief description of the research carried out in each. It also describes mechanisms that might be used to identify and exploit technology transfer opportunities. Methods whereby local authorities and individuals might supplement and complement technology transfer mechanisms already in place through various government and university programs are also examined. An example of such a government program is the Industrial Research Assistance Program (IRAP) which is operated by the National Research Council (NRC), and an example of a university program is the Commercial Development Officers (CDOs) program which is supported by the Province of Ontario.

Part 1: Technology Venturing

1 Introduction

Federal laboratories are a prime source of technology that can lead to the creation of new business ventures.

A significant technology-oriented complex has grown up in the Ottawa area during the past twenty-five years. There are now over 350 high technology firms in the area employing over 20,000 people. The origins of many of these firms can be traced directly to the many government laboratories in the area. For example, Leigh Instruments Limited, one of Canada's leading avionics firms, was formed to commercialize a crash position indicator that was developed at the National Research Council. Gandalf Data Limited produced its first product as a result of a meeting between a salesman-entrepreneur and a computing director in the Department of Communications, who identified a requirement for a unique computer communications device. This one product led to a $100 million company. There are many other similar examples, most of them traceable to accidental meetings and interactions between scientists, entrepreneurs and investors.

As federal laboratories and research facilities have become more decentralized across Canada in recent years, there have been signs of similar industrial complexes emerging elsewhere. The City of Saskatoon is one example where there are over 50 high technology firms; many of them can be traced to the various research laboratories in that area. The Province of Saskatchewan has implemented a series of programs aimed at helping these companies to exploit such opportunities to the fullest, as well as helping entrepreneurs to form new companies. A technology venturing experiment carried out in the province in 1983 is described in Section 6. It formed the basis for many of these programs.

In the federal government, there are over 60 different departments and agencies either performing science and technology (S&T) activities directly or contracting them out to industry and universities. Some departments such as Environment spend most (94%) of their budgets intramurally, that is, on research in their own laboratories, while others such as Defence and Energy, Mines and Resources contract out as much as 50% of theirs. More details on the breakdown of intra- and extramural expenditures by departments are provided in Chapter 4.

The total federal expenditure on science and technology activities is in excess of $4 billion per year, and approximately one third of this or $1.3 billion goes towards intramural research. This research is related to almost every aspect of science and technology, and it is carried out in laboratories spread throughout Canada. It therefore presents Canadians from nearly every walk of life and from nearly every locality with opportunities to benefit from government research through the creation of new business ventures.

The interaction between the scientific and investment/entrepreneurial communities that is so critical to such ventures is often accidental. Experience in the Ottawa area has shown that these new businesses start when a scientist or technologist puts a business plan on the table and an investor or entrepreneur puts risk money on top of it. Economic development officers (EDOs) can play a key role in this process. A number of steps are involved including the market research that must precede the actual writing of the business plan and which is usually the most difficult part of the whole exercise. However, the early identification of exploitable technology is often just as important and just as difficult as the market research. This handbook focusses on that identification phase of the innovation chain.

2 A New Ventures Strategy in Your Community

Community leaders and EDOs are anxious to see their municipalities share in the benefits of technology exploitation. Technology-based firms are generally higher growth firms and as they reach maturity they tend to spawn other firms at a faster rate than resource-based firms do. Also, such firms tend to consume supporting goods and services at a greater rate than others of a similar size. Finally, the presence of a strong technology "culture" in the community tends to cause the other non-technology firms (e.g. the resource-based firms) to apply new technology to their operations sooner than they otherwise might. This in turn can lead to increased efficiency and greater sales and stability for those firms.

While it is tempting for an EDO to seek out the larger, more mature high technology firms and try to encourage them to set up a facility in the community, it is very often a non-productive and discouraging exercise. Such firms are receiving these same overtures from nearly every city and municipality throughout North America. They are not easily influenced by the ordinary methods of promotion, and what they are looking for in a site location consists of many more things than cheap land and good transportation.

Even if a municipality is lucky enough to attract such a facility, it may not lead to the growth and prosperity that was sought. A branch plant can suffer extreme fluctuations as business fortunes of the parent corporation rise and fall. Also, a change in ownership or even corporate structure can have a negative impact as the inevitable "consolidation" takes place. On the other hand, an increased demand for the products being supplied from that plant can be beneficial to the community even though the entire corporation's business is flat. The point is that branch plants are not only difficult to attract, they can have significant fluctuations in activity which are beyond the control of local management.

2.1 Growing Your Own

A more viable strategy for a community might be to grow and develop its own companies from the start. This is easier to do where a significant R&D complex exists. Indeed, a research laboratory can be likened to a mineral find, except that the exploration and extraction process can be more difficult. Fortunately, an EDO can accelerate and simplify this extraction process. He or she can do this by playing the very vital role of "matchmaker" between the community's "technology engine" and its "investment engine".

Figure 1
The Role of the Economic Development Officer in the Technology Diffusion Process

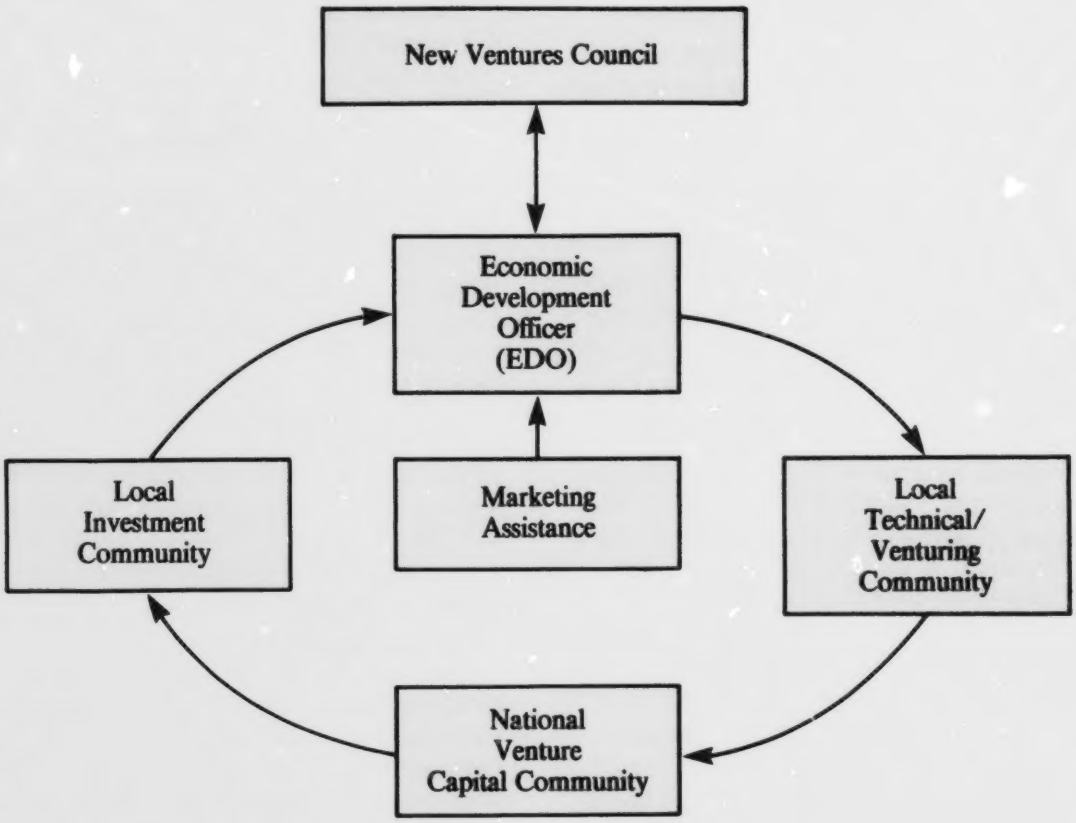


Figure 1 illustrates a community process that can be used to implement such a matchmaking role. The starting point is the establishment of an advisory body to the EDO known as a New Ventures Council. This would be a group of volunteers drawn from both the financial and the technical communities. Its principal role is to prospect for new business opportunities and would-be entrepreneurs and to make them known to the EDO.

If the opportunity is obviously a good one, the entrepreneur would be given some help by the EDO in preparing a business plan. Input to this process may also be required from other members of the New Ventures Council. If there are any questions at all about the viability of the proposed new venture, the entire council may want to meet and review it.

By far the most difficult task in preparing a business plan for a technology intensive venture is the market research. Yet it must be done and it must be done in such detail that the revenue projections that fall out of it have credibility for the potential investor(s). It is not good enough to say something like: "The total North American market for portable seismic instrumentation is X million dollars a year and it is growing at 20% a year, and this company plans to capture Y percent of it by the fifth year". The target market(s) will have to be

identified; the market potential and the penetration rate will have to be discussed. Finally, the market share will have to be justified by explaining the price/functionality advantage over competing products, the channels of distribution and the marketing communications program to be used.

Although expertise in market research may exist at the local level, particularly if there is a university in the region, outside help may be required. The New Ventures Council can provide assistance in locating such help, and in some instances they can provide it themselves.

After the business plan is completed, it is reviewed by the council. What happens to it after that will depend on whether the entrepreneur wants to strike out on his own to implement it or an institution or individual is merely making the opportunity known for someone else to exploit it. In either case, the business plan will be presented to the investment community. The local investment community is usually the best source of both the financial and human resources required to implement the plan. It would raise the necessary seed capital, assemble a board of directors, hire the entrepreneurs (including the top one if necessary) and put together an operating budget.

While it may be possible to attract the interest of the national venture capital community at this stage, it is not likely. The national venture capital community is shown in Figure 1 as being a link in the chain which includes the EDO, the local investment community and the local technical/venturing community, but it seldom figures in small seed capital financings. Experience in the Ottawa area and in other technology-oriented complexes in Canada has shown that such initial financing must come from the local investment community but that the national venture capital companies will come in on second and subsequent rounds of financings. Of course, the enterprise must show some prospects of success before any follow-on financing will be achieved. This is another area in which the local community can help. A team effort of the type proposed can contribute to this initial success in the following ways:

1. It can provide the new entrepreneurs with mentors.
2. It can provide the new company with purchase orders.
3. It can make the new venture known to business associates outside the community.
4. It can help to recruit a board of directors.

2.2 Identifying the Investment and Technology Communities

Every community has investment and technology "engines". They are obviously smaller and less powerful in some communities than in others. Even though the concept of an "investment engine" or venture capitalism may seem foreign to a small rural municipality, the fact is that the farmer plays the role of a venture capitalist every year by buying seed and fertilizer in the spring and betting on them producing crops in the fall. A person who spends his or her own money to buy and renovate a restaurant or hardware store or car wash and then bets on people coming in to buy the goods and services offered is also practising venture capitalism.

On the technology side, a farmer who develops a better way to pump water to livestock or to handle feedstock or to plow the field is an innovator. Canada's farming community is a vital component of the country's overall technology engine. Indeed, many of the machinery add-ons that the major manufacturers have introduced over the years have come about as a result of a farmer developing the product and selling or giving a few to neighbours. This is the best possible form of innovation, because nobody can assess the features, functions and benefits of such add-ons better than the users. The adage that "necessity is the mother of invention" has more relevance in rural communities because of the close relationship between the supplier and the user. This means that the innovation cycle is usually much shorter and the whole process is much more focussed towards meeting a real need. By contrast, it is not uncommon for products which are designed and developed in large corporations to miss the mark entirely either because the innovation cycle is too long or the requirement is poorly understood.

Smaller inventors do suffer from a number of disadvantages such as a lack of marketing, selling and financial resources which is not usually encountered in large corporations. However, if the appropriate matchmaking is achieved between the technology community and the investment community, such resources can be marshalled even in the smallest communities. The body of experience which resides in the New Ventures Council can be invaluable in this process.

3 Where are Canada's "Technology Engines"?

Historically, nearly all federally funded research was done in the National Capital Region (NCR). It began with the establishment of the National Research Council in 1916 and the building of the first NRC laboratory some fifteen years later. Since then, the NRC has expanded to a multi-laboratory organization, and it has spun off other organizations which have grown and expanded on their own. Examples are the various Defence Research Establishments, Atomic Energy of Canada Limited, and the Natural Sciences and Engineering Research Council (NSERC).

Although it can be argued that federal S&T expenditures are still unevenly distributed across the country, they are now considerably less concentrated in the National Capital Region than they were even a decade ago. This is partly the result of the government's overall policy of decentralization, but it is also related to factors such as:

a) The emergence of excellent post-graduate research facilities at several Canadian universities which are partially funded by NSERC and other government agencies and departments.

b) The broadening scope of research on regionally specific problems which has necessitated the establishment of research facilities in the locations of the problems being addressed. For example, the Agriculture Canada research stations across the country specialize in the crops and conditions unique to the regions in which they are situated.

In 1983, the National Capital Region had 29% of the federal S&T expenditures, Ontario was second with 22% (outside the NCR), and Quebec was third with 15%. Figure 2 shows the breakdown for all regions. Figure 3 shows the expenditures by performance — namely: intramural, industry, universities and other. It shows that the industrial involvement is very high in Ontario and Quebec, which is to be expected since that is where most of Canada's manufacturing facilities are located. However, as will be seen in Section 6, technology intensive firms can be created in any region where even a minimum technology community exists.

Figure 2
Federal S&T Expenditures (NSE)* by Region, 1983/84

Region	$ Million	%
British Columbia	238	8.7
Alberta	153	5.6
Saskatchewan	71	2.6
Manitoba	163	5.9
Ontario (Excludes NCR)	596	21.7
National Capital Region (NCR)	793	28.9
Quebec (Excludes NCR)	457	16.6
New Brunswick	44	1.6
Nova Scotia	163	5.9
Prince Edward Island	8	0.3
Newfoundland	59	2.1
Total	**2,748**	**100.0**

* Natural sciences and engineering
Source: Statistics Canada — Catalogue 88-001

Figure 3
Federal S&T Expenditures (NSE)* by Region, by Performer, 1984/85 (%)

Region	Intramural	Industry	Universities	Other	Total
British Columbia	51.3	13.0	33.6	2.1	100.0
Alberta	60.8	11.1	26.8	1.3	100.0
Saskatchewan	63.4	7.0	22.5	5.6	100.0
Manitoba	79.9	4.7	12.9	2.5	100.0
Ontario (xNCR)	48.3	17.1	29.2	5.2	100.0
NCR	88.8	8.1	2.5	2.1	100.0
Quebec (xNCR)	43.8	28.9	23.2	4.2	100.0
New Brunswick	52.3	20.5	15.9	11.4	100.0
Nova Scotia	78.5	7.4	11.7	2.5	100.0
Prince Edward Island	87.5	12.5	—	—	100.0
Newfoundland	72.9	5.1	13.6	8.5	100.0
Total	**65.0**	**13.4**	**17.9**	**3.1**	**100.0**

* NSE — Natural sciences and engineering
Source: Statistics Canada — Catalogue 88-001

Understanding the Federal Research System

In 1984/85, the total federal expenditures on S&T activities were slightly in excess of $4 billion. An overview of how and where these expenditures occur is a necessary first step in exploiting the technology they create.

By international convention, S&T activities are broken down into Natural Sciences and Engineering (NSE) and Social Sciences and Humanities (SSH) activities. Each of these can be further broken down into Research and Development (R&D) and Related Scientific Activities (RSA).

Using these definitions, Figure 4 illustrates how the $4.005 billion of federal expenditures for 1984/85 were distributed. About $1.9 billion were allocated to intramural NSE work. Of this amount, about $1.3 billion were for R&D, $600 million for RSA and $57 million for the administration of extramural programs. The greatest opportunities for technology transfer of the type being discussed in this handbook lie within the intramural and university R&D sectors for NSE — $1.344 billion and $454 million respectively.

Figure 5 shows a breakdown of the NSE expenditures by department and the percentage which each department spends intramurally, in industry and in other places. Departments having high percentages in the column marked "R&D/ Intramural" are likely to represent good opportunities for technology transfer. This is subject to several caveats; for example, an Agriculture Canada field laboratory that specializes in providing inspection, standards or calibration services may not be working on any projects that could lead to outside products or services, even if the department as a whole is spending 90.4% intramurally. Nevertheless, the intramural column provides a good starting point in the search for opportunities. A detailed breakdown of the distribution of scientific staff and of the activities in which they are engaged is provided in Part 2 of this handbook.

Figure 5 also shows that the departments that have most of the responsibility for regulatory activities, such as Environment Canada and Health and Welfare Canada, spend approximately two thirds of their S&T budgets on RSA, while others, such as Agriculture Canada and the Departments of National Defence and Communications spend more than 90% of theirs on R&D. Such large amounts of spending on RSA should not be overlooked, however, especially if they are spent intramurally; it probably means there is significant potential for service-related new ventures.

The same is true to a lesser extent of the entire SSH S&T component in Figure 4. It is important to understand what is in this component: the Economic Council of Canada is an example of an organization in the R&D column of SSH S&T, and Statistics Canada is an example of one in the RSA column. Certainly Statistics Canada is a user of consulting and other services, but since most of the Statistics Canada facilities are located in Ottawa, there is probably little that an EDO or economic development agency in a distant city can do to stimulate a local service industry aimed at the Statistics Canada market. In fact, such services are highly specialized and there is probably little that anyone, other than potential suppliers, can do to access them through any form of promotional effort.

The SSH sector will not be discussed in any detail in this handbook. Nevertheless, it is useful to know what is in it, if for no other reason than to understand the difference between it and NSE.

Figure 6 provides a breakdown by major application area of the $1.2 billion of federal intramural R&D on natural sciences and engineering for the year 1984/85. Five areas stand out above the rest in terms of spending, namely: food, energy, security, natural resources, and industry support. Two departments stand out from the rest as being the most diverse in their activities, namely: Energy, Mines and Resources and the National Research Council. As will be seen in Part 2, both of these organizations are also widely dispersed geographically, although they are well behind Agriculture and Environment in this regard.

The main point of the above discussion is that the federal involvement in S&T activities is a complex mosaic of geography and application areas. Understanding that mosaic is the first step in the economic exploitation of the technology which results from those activities.

The following chapter describes some of the tools that a community assistance centre of the type illustrated in Figure 1 might use. The first such tool is a business plan.

Figure 4
Federal S&T Expenditures 1984/85
(Millions of Dollars)

Total S&T
3,874

	NSE S&T 3,151		SSH S&T 723	
	R&D	**RSA**	**R&D**	**RSA**
Total	2,347	804	153	570
Intramural	1,333	637	57	502
Industry	416	81	5	12
Universities	450	44	56	23
Other	148	42	35	33

Source: Statistics Canada

Figure 5
Federal S&T Expenditures By Major S&T Performing Departments and Agencies NSE, 1984/85

Department or Agency*	Total S&T $M	% of Total S&T							
		R&D				RSA			
		Intramural	Industry	Others	Total	Intramural	Industry	Others	Total
NRC	484.5	59.3	19.9	10.6	89.8	9.8	0.3	0.1	10.2
EC	328.1	15.6	1.5	0.8	17.9	78.5	0.7	2.9	82.1
EMR	316.3	52.7	11.1	5.8	69.6	20.8	5.7	3.9	30.4
AC	312.0	85.0	1.9	2.9	89.9	10.0	0.1	0.0	10.1
F&O	259.4	52.0	2.0	1.7	55.7	41.8	2.2	0.3	44.3
DND	192.0	64.4	27.6	7.1	99.1	0.9	0.0	0.0	0.9
AECL	150.3	82.2	3.5	2.0	87.6	5.9	6.4	0.1	12.4
DOC	92.4	62.0	16.7	14.0	92.7	0.6	6.3	0.2	7.1
HWC	87.5	19.5	0.8	9.8	30.1	64.2	0.8	4.8	69.8
Forestry	75.0	72.8	10.1	7.0	89.9	9.5	0.1	0.6	10.1
TC	43.7	24.9	44.9	4.8	74.6	15.3	8.9	1.2	25.4
Others	76.8	10.5	19.5	4.9	34.9	50.8	5.7	8.6	65.1

Source: Statistics Canada
* Explanation of acronyms at the end of Part 1.

Figure 6
Federal Intramural R&D Expenditures (NSE) in Selected Application Areas 1984/85 ($ Millions)

Dept. or Agency*	Advance. of Science	Communi-cations	Energy	Environment	Food	Health	Industry Support	Oceans	Natural Resources	Security	Space	Trans-portation	Other	Total by Dept.
NRC	34.5	—	31.2	4.6	25.3	17.6	93.4	—	—	4.4	16.3	40.0	—	267.3
AC	—	—	—	—	240.2	—	—	—	—	—	—	—	—	240.2
EMR	1.5	0.4	48.6	5.5	—	0.3	—	10.8	51.7	0.4	—	0.1	30.4	149.7
F&O	—	—	7.8	15.5	64.3	—	—	42.6	—	—	—	1.1	—	131.3
AECL	—	—	116.6	—	—	6.9	—	—	—	—	—	—	—	123.5
DND	—	—	—	—	—	—	—	—	—	121.7	—	—	—	121.7
DOC	—	49.8	—	—	—	—	—	—	—	—	5.6	—	—	55.4
Forestry	—	—	0.2	—	—	—	—	—	47.8	—	—	—	—	48.0
EC	—	—	3.1	16.2	—	—	—	—	10.1	—	3.9	—	11.7	45.0
HWC	—	—	—	—	—	14.4	—	—	—	—	—	—	—	14.4
TC	—	—	0.7	—	—	—	—	—	—	—	—	9.1	—	9.8
Others	8.4	0.2	1.9	0.1	0.3	3.5	10.0	0.1	0.1	0.1	—	—	0.4	25.1
Total by activity	**44.4**	**50.4**	**210.2**	**41.9**	**330.1**	**42.7**	**103.4**	**53.5**	**109.7**	**126.6**	**25.8**	**50.3**	**42.5**	**1,231.5**

* Acronyms defined at the end of Part 1.
Source: Statistics Canada

5 Tools for Transferring Technology

Technology transfer can take on many different forms and have many different results. For example, it can take the form of people, because a scientist leaving a laboratory takes along knowledge and experience. If the scientist forms a company, the technology is transferred to a product or service which is used to exploit a market and produce revenue. This in turn produces wealth for the community.

However, it is not always necessary to take the scientist or technology developer out of the laboratory. If outside investors can be made sufficiently knowledgeable about the commercialization opportunities, they will find their own management teams to exploit them. This is often a more effective form of transfer and one that can have greater long-term benefits for all concerned. The scientist can remain in the laboratory doing what he or she does best, and the investors and managers can call upon that person as a consulting resource in the future.

Most technology transfer processes involve licensing and royalty payments. In the case where an ongoing working relationship is envisaged, the payments may be a combination of payments for research work, for consulting, for access to future technology, and for royalties on sales revenues.

5.1 The Business Plan

The starting point in any new business venture should be the preparation of a comprehensive business plan which shows what the investors are investing in and how much return they will get on their investment. Such a plan should definitely be written if a new company is being formed. Also, if technology is being transferred to an existing corporation for the purpose of initiating a new product or service, then the business outlook for that product or service should be similarly planned. The primary purpose of the business plan is to identify the incremental revenue and profit that such a new product or service can generate. This is what places a value on the technology to be transferred.

Whether or not there is an adequate payback will depend on the total investment required to launch and sustain the enterprise. The licensing fees and royalty payments are only two of the many components of such investments. For example, most new ventures require additional capital equipment and inventory and these require risk investments in addition to debt. The latter comes from the bank but the former does not: in a large corporation the funds come from the corporate treasury or outside shareholders; in a start-up corporation they come from investors.

The following is a suggested format for a business plan:

5.1.1. The Opportunity

(Suggested length — ½ page). This is a simple statement of why an investor would consider this new venture as opposed to something else. The following is an example: "The research into seismic sensor technology which has been carried out in the Department of Geology at Canuck University has resulted in the identification of a new type of blast monitoring device that could be marketed in large quantities to the construction, mining, and quarrying industries". It should be expanded upon to the point where the reader can visualize the extent of the opportunity and the risks involved — at least from a technology standpoint. The investor should know from the first sentence if the investment being requested is for an anti-gravity device or a device whose technology is defined and achievable.

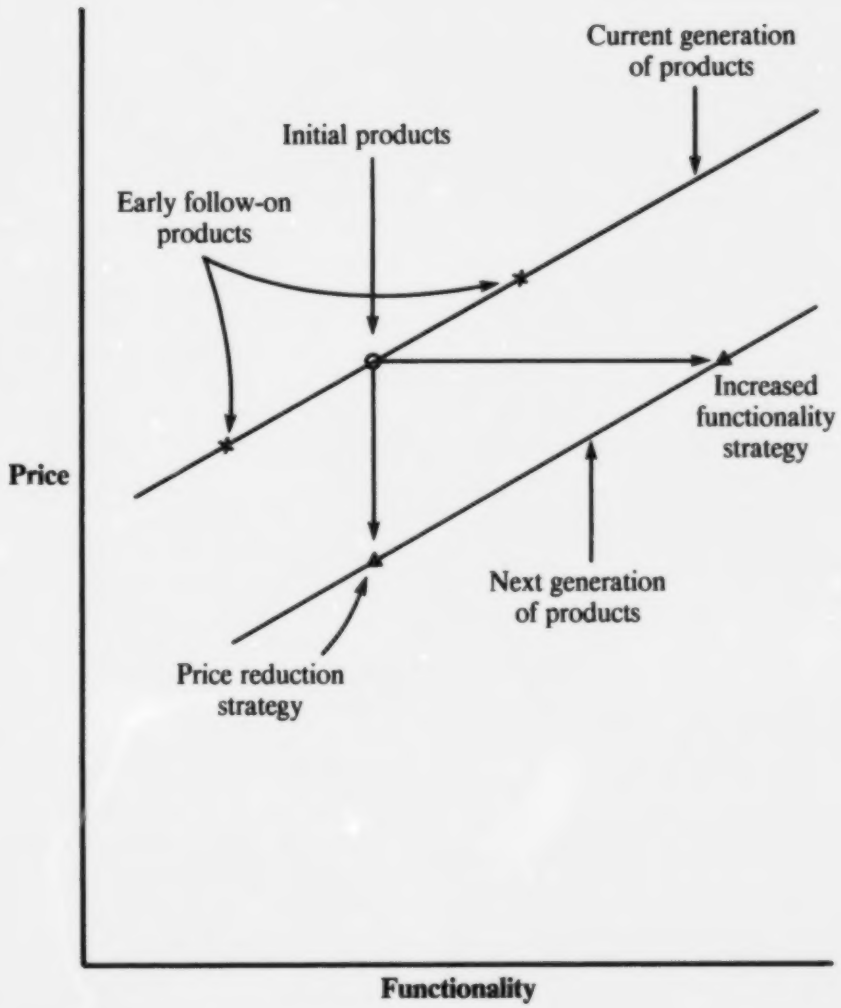
5.1.2 The Products and/or Services

(Suggested length — 1 to 2 pages). Using non-technical language, explain the purpose of each product or service and the reason why it is being developed. Describe the features, functions, and benefits of each and compare them to competitors' products on the market. Some of the questions you should answer are:

- What is the purpose of the product or service?
- How does it achieve this purpose?

- What are its unique features (cost, design simplicity, etc.)?
- What is its technological life (how soon will it become obsolete)?
- What is its stage of development (idea, engineering model, engineering prototype, productions prototype)?
- How will the product be produced? (Is it capital intensive, labour intensive, material intensive? Will some or all production be subcontracted?)
- Can the product be protected by patent, copyright or trademark?

Figure 7
Product Migration Strategy



Finally, a product migration strategy should also be discussed, because, as exciting as the initial product offerings might be to both the scientist and the entrepreneur, investors will want to be assured that the company will be able to compete with new entrants to the marketplace. Figure 7 is an example of a product migration chart which can aid in this thought process. It shows price on one axis and functionality on another. In planning the new venture, the first product or service should be followed up very quickly with two others — one with a lower price and lower functionality and the other with a higher price and a higher functionality. This family of products should all be possible with today's technology and it should offer the customer clear buying choices.

However, some thought should also be given to the next generation of products. An ideal product migration strategy will call for each product to evolve along both axes simultaneously, thereby giving rise to two new products or even a family of products. In one case the new product will have increased functionality at the same price, and in the other case it will have the same functionality at a lower price. There are many ways of achieving this, but for technology intensive products the new family will likely be based on a new generation of technology. It is therefore necessary to do some technology forecasting, and of course technologists are the best people to do this — another reason why the technology exploitation opportunity can often be captured more precisely by the technologist than by the investor or a third party "business planner".

5.1.3 The Market

(Suggested length — 3 to 10 pages). This section should address the following questions:

- Who and where are your customers (Canada, North America, offshore)?
- How will you distribute your product (direct sales or dealer network, transportation, export implications, tariffs and duties, barriers, foreign exchange)?
- What are your market share objectives (rationale and costs of achieving different levels)?
- What are other important factors (seasonality, regulatory requirements, assistance programs available, market trends, etc.)?
- Competition — What are the alternative solutions? How do they compare in cost? What is your competition likely to do when this product or service is introduced?

The main purpose of this section of the business plan is to arrive at projected revenue figures which have credibility for the potential investor. It is a very difficult process, but a very necessary one. The following are some of the marketing terms that a business planner must understand:

- target market
- market segment(s)
- potential market
- market penetration
- market share
- market maturity

It is beyond the scope of this handbook to provide a tutorial on marketing, but anyone attempting to write a business plan should understand the meaning and the role of these terms. They can be found in any good book on marketing.

5.1.4 Financial Projections

(Suggested length — 2 pages). Even though the product is not yet fully defined and the market research is not as complete as you would like it to be (it never is), there comes a point in the planning process where revenue projections must be made. The first year's projections should be done on a monthly basis, the second on a quarterly basis and the next three on a yearly basis. While the first year's figures will be based on specific target markets, and maybe even specific customers, obviously anything beyond the second year must be based on estimated market size, market trends and anticipated market share.

The same is true of expense projections. There should be good visibility of engineering, manufacturing, marketing and other costs for the first year at least, but for the final years, they will likely be

based on a pricing model in which such costs are taken as a percentage of revenue. The following is a typical pricing model for a technology intensive goods producing company in which significant ongoing investments in research and development and marketing are required.

Sales Revenue	100%
Cost of Goods Sold (Mfg. Costs)	50%
Gross Profit	50%
Marketing, Selling & Distribution Costs	15%
Engineering Costs	10%
General & Admin. Costs	8%
Total Operating Costs	33%
Profit before Taxes	17%

The above model assumes that warranty costs are included in the "cost of goods sold", interest costs are included in "general and administration", and that the products are serviced by a separate cost centre which must return a profit to the corporation.

5.1.5 Investment Requirements

(Suggested length — 2 pages). The final step in the business planning process is a cash flow analysis. Before an investor will put money into a new venture, he or she will want to know how much total money it is going to take to turn the venture into a viable ongoing business that can attract funds from conventional sources (e.g. the banks, government programs, the stock market). Almost every new business loses money in its first year or two, and those losses must be financed by the founding investors. Those same investors must also buy the capital equipment that is needed to start the new enterprise, and they must finance most of the inventory and the accounts receivable until the company has generated cash of its own.

These investment needs must be estimated and presented in a five-year cash flow analysis. Such an analysis records all the outflows of capital as well as the inflows from earnings, new equity financings, bank loans, government grants, etc. It is not an onerous exercise once the operational variables have been defined and projected. And since the operational variables depend so much on accurate revenue projections, the importance of the marketing section of the plan cannot be over-emphasized.

5.2 An Inventory System

Using the above business planning format, it is possible to keep an inventory of technology transfer opportunities at a community level.

Figure 8 shows a format for a summary sheet that the director of a new ventures centre might want to use for this purpose. The headings of each of the columns coincide with those suggested for the business plan, namely:

The Opportunity

A brief statement telling a prospective investor if this opportunity fits into a field of interest.

The Product/Service

A description of the products/services that a new company might deliver or the new product line that an existing company might deliver — each one should be on a separate line.

The Market

A summary of the markets where each product or service might be sold.

Revenue Projections

A broad estimate of how much revenue the new venture could be achieving in five years.

Investment Requirements

The amount of equity financing required.

Comments

An indication of market readiness, the stage of development, licensing arrangements, etc.

Figure 8
Suggested Format for Summary Sheet of Potential Business Opportunities

Field of Opportunity	Product/Service	Market	Potential Annual Revenue (Within 5 Years)	Investment Requirements	Comments
Service for testing multi-conductor signal cables	An electrician's tool, this portable device rapidly "rings-out" signal cables after they are assembled and installed. It rapidly identifies shorts, open circuits, or cross-wiring errors. A 55 conductor cable can be tested in a few seconds. It can be tested by one tradesman, even if the cable ends are remote from each other.	Electrical equipment distributors and installers Communications Process control	$3M+	$250,000	Prototypes built and tested. Units in use on site. (ABC laboratories)

6 The Saskatchewan Experiment

An experiment in this kind of technology venturing was carried out in the Province of Saskatchewan in 1983. Within a six month period over 100 potential business opportunities were received and approximately half resulted in business plans which were considered to be worthy of review by investors. About a quarter of these resulted in new business ventures within that six month period or very shortly thereafter. The exercise created a focus on the front end of the innovation process which has become the mainstay of the Saskatchewan science and technology strategy.

Over a four year period, that strategy produced the following results:

Year	1982	1986
Number of Firms	39	142
Sales	$81M	$400M
Employment	1097	2735

It has also created a greater awareness of the incubation process within both the scientific and investment communities. This has led to greater teamwork and an acceleration of the technology diffusion process generally.

The following are some additional results that might be of interest to others who want to follow a similar strategy:

- Scientists can and will write business plans. They enjoy the market research portion since it follows scientific principles which they use in their regular research activities.
- More ideas were generated by the non-scientific community than by the scientific community. Examples of would-be entrepreneurs from the non-scientific community were computer store employees, public service employees, distributors and suppliers of agricultural machinery and various people from those industrial sectors which supply the high technology industry.
- The entrepreneurs were all reluctant to give up equity in the new ventures. In fact there was a general lack of understanding about the difference between equity and debt financing. A great deal of time was spent in counselling entrepreneurs on this question. EDOs can aid in this process.
- The members of the New Ventures Council accepted their positions willingly and served with great enthusiasm.
- A venture capital community emerged and coalesced as a result of the experiment. The province enacted legislation shortly after the experiment to provide incentives for small business investments through vehicles known as Venture Capital Corporations (VCCs). Within two years, about six VCCs were formed specifically to pursue technology opportunities.
- The prospecting effort required was significantly less than anticipated. When the people with the ideas (particularly those in the laboratories) learned that such assistance was available, they came forward on their own.
- The planning exercise acted as an effective qualifying process for would-be entrepreneurs. A number of individuals who had lobbied for government grants or who had criticized some higher authority for not recognizing the value of their ideas would not accept the discipline of the planning process even when help was provided to them free.
- The importance (and the difficulty) of doing good market research was underestimated by all would-be entrepreneurs. Even the people who were planning to provide goods or services to the agriculture market knew very little about the potential market and possible penetration rates. They did not know how many farms there were in Saskatchewan or how many pieces of equipment there were in the province that were of a cost and functionality that would warrant a given add-on device. In fact, many were surprised to learn such information is readily available. This suggested the need for instant access to

generic marketing data in addition to that which would help in identifying and measuring "niche" markets.

The Saskatchewan experiment was followed by a comprehensive technology development program which is administered by the Department of Science and Technology. Approximately a dozen different forms of financial and technical assistance are now available to firms at all stages of their development. For example, the original technology venturing project is continuing under the Inventors and Entrepreneurs Program. It provides business planning advice, market research assistance and a patent search service. An example of another program is a First User Risk Reduction Program which provides a prospective customer with an incentive to buy the first product.

7 Conclusion

It is now obvious that Canadians must rely very heavily on technology for future economic development. The kinds of companies and jobs and communities that will result will be very different from those produced by resource-related industries. We should not be frightened by that challenge. Our goal should be to establish new technology-related businesses at the same rate that new farms were created at the turn of the century.

Community administrations and local development groups can play a key role in that process. They will find government at all levels to be co-operative because technology-based industrial activities benefit everyone. The federal government is interested in promoting the diffusion and exploitation of any technology that results from its research and development activities.

This handbook is intended to assist in that promotion.

Technology Venturing Acronyms

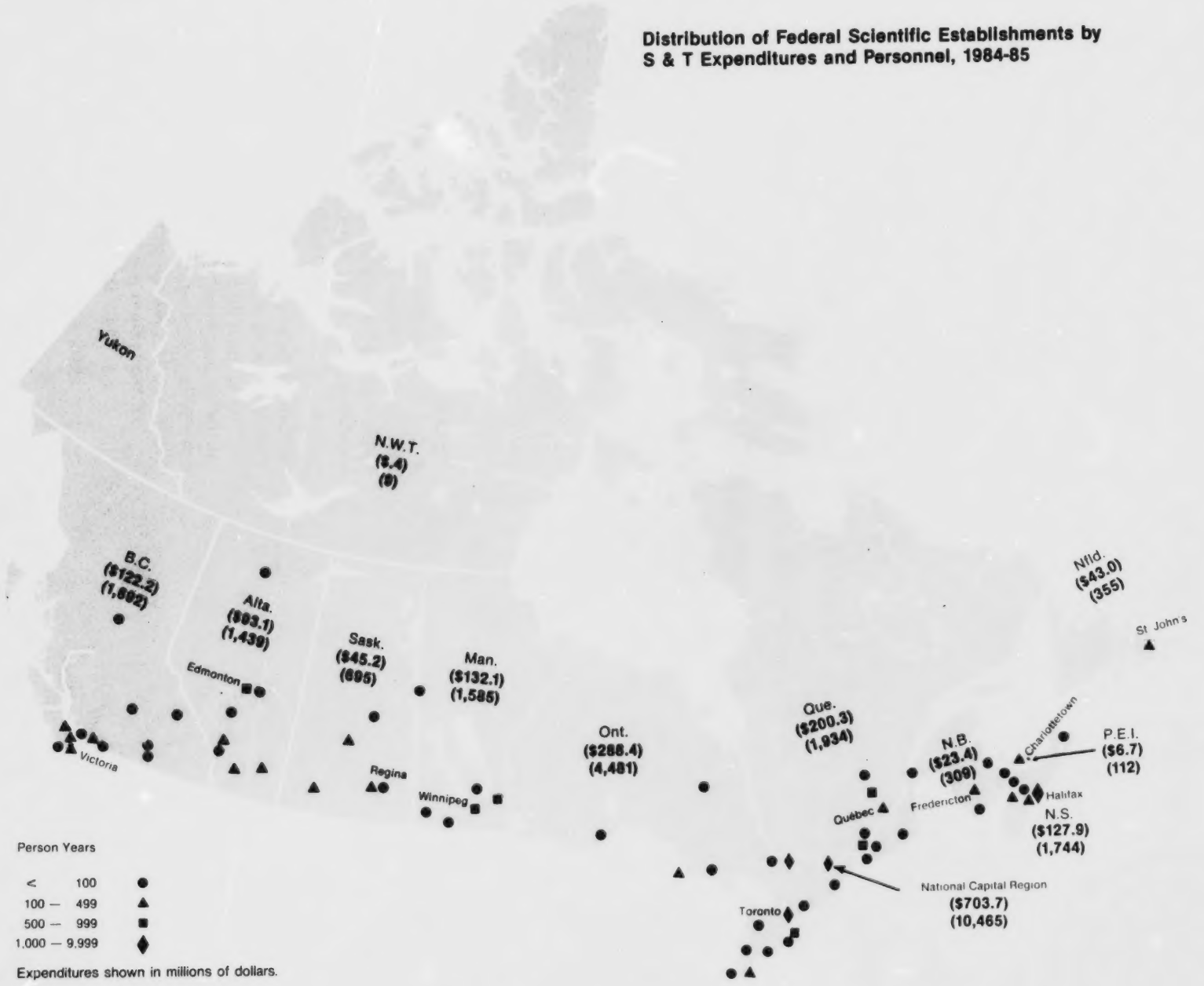
AC	Agriculture Canada
AECL	Atomic Energy of Canada Ltd.
DND	Dept. of National Defence
DOC	Dept. of Communications
EC	Environment Canada
EDO	Economic Development Officer
EMR	(Dept. of) Energy, Mines and Resources
F&O	(Dept. of) Fisheries and Oceans
HWC	Health and Welfare Canada
NCR	National Capital Region
NRC	National Research Council
NSE	Natural Sciences and Engineering
NSERC	Natural Sciences and Engineering Research Council
R&D	Research and Development
RSA	Related Scientific Activities
S&T	Science and Technology
SSH	Social Sciences and Humanities
TC	Transport Canada

Part 2:
A Directory of Federal Research Establishments by Province and Department

Source: Statistics Canada

Directory of Federal Government
Scientific and Technological
Establishments, 1986
Catalogue No. 88-206E

Distribution of Federal Scientific Establishments by S & T Expenditures and Personnel, 1984-85



REGION A - NEWFOUNDLAND

AGRICULTURE CANADA

Newfoundland Forest Research Centre
P.O. Box 6028, St. John's, Newfoundland A1C 5X8
Contact: Dr. J.A. Munro, Regional Director, Tel: (709) 772-4683
Personnel: Total is 67.
Activities: The centre conducts most of the forest research in the Province. Its work is directed primarily towards satisfying the requirements of the Provincial Government and the Newfoundland forest industries. Its objective is to provide scientific, technological and economic information and services required for the improvement, protection and efficient utilization of the forest resources.

Research Station: St. John's
P.O. Box 7098, St. John's, Newfoundland A1E 3Y3
Contact: Dr. H. Davidson, Director, Tel: (709) 772-4619
Personnel: Total is 36.
Activities: Multidisciplinary research at St. John's is directed towards the control of potato wart and golden nematode diseases, clubroot disease of turnip, and economic crop insects, as well as plant nutrition and vegetable adaptation trials. Emphasis is placed on increasing vegetable and forage production on peat soils.

FISHERIES AND OCEANS

Fisheries Research Branch - Newfoundland Region
Northwest Atlantic Fisheries Centre, P.O. Box 5667, St. John's, Newfoundland A1C 5X1
Contact: Mr. M.C. Mercer, Research Director, Tel: (709) 772-2027
Personnel: Total is 218.
Activities: The fisheries research programs of the Fisheries Research Branch are directed toward the provision of essential scientific information for effective management and rational use of marine and freshwater fish, shellfish and marine mammal resources in the Newfoundland and Labrador area. Research responsibilities extend from the Laurentian Channel and Grand Banks to Davis Strait involving temperate, sub-Arctic and Arctic investigations in fisheries science. With the advent of increased offshore oil activity in the Newfoundland-Labrador region, a research program on the lethal and sub-lethal effects of oil on various stages in the life history of marine organisms has commenced. Research directed at protection of the habitat of marine and freshwater species is also conducted by the branch. Research is conducted into the life history, ecology and population dynamics of the major groundfish, pelagic, shellfish, marine mammal, freshwater and anadromous species in the Newfoundland-Labrador area. Research also includes mechanisms involved in the complex interaction between various species and their environment, as well as the interactions among the various species within the ecosystem. Further work is undertaken on the effects of natural and man-made contamination of freshwater and marine resources in keeping with fish habitat research and management functions, as well as studies of pathogenic bacteria particularly on the relationships of endotoxin structure and virulence of fish pathogens.

Newfoundland Inspection Division - Seafood Quality Investigation
Northwest Atlantic Fisheries Centre, P.O. Box 5667, St. John's, Newfoundland A1C 5X1
Contact: Mr. David R.L. White, Chief, Inspection Division, Tel: (709) 772-4424
Personnel: Total is 3.
Activities: Technological research, support and consulting services in basic and applied seafood science are provided for use by the Inspection Branch and the Newfoundland fishing industry. Investigations and advisory services are concerned with handling, processing and preservation of fish and fish products on-board and at factories and the further utilization of under-utilized species. Emphasis is placed on scientific support to inspection and quality improvement programs particularly with respect to sensory and chemical indicies of quality.

NATIONAL RESEARCH COUNCIL CANADA

Institute for Marine Dynamics: St. John's
St. John's, Newfoundland A0X 1X1
Contact: Not Available.
Personnel: Total is 30.
Activities: NRC is currently establishing a marine engineering facility on the campus of Memorial University of Newfoundland at St. John's, in support of Canada's Oceans Policy for achieving an internationally recognized excellence in operating on or below ice-covered waters. The Centre will promote and assist in the development and construction of vessels and fixed structures, and will provide NRC and Canada with an integrated, world class centre of excellence in marine and ice dynamics.

Technical Information Service: St. John's
44 Torbay Road, St. John's, Newfoundland A1A 2G4
Contact: Not Available.
Personnel: Data not available.
Activities: Part of NRC's Field Advisory Service (see Industry Development Office - page XX).

REGION B - NOVA SCOTIA

AGRICULTURE CANADA

Experimental Farm: Nappan
Nappan, Nova Scotia B0L 1C0
Contact: Mr. F.W. Calder, Superintendent, Tel: (902) 667-3827
Personnel: Total is 34.
Activities: Research programs are concerned with the management of beef, sheep, and swine, and on their nutrition and feed crops requirements.

Research Station: Kentville
Kentville, Nova Scotia B4N 1J5
Contact: Dr. G.M. Weaver, Director, Tel: (902) 678-2171
Personnel: Total is 118.
Activities: Kentville is the Atlantic regional centre for research on horticultural products including strawberries, blueberries, ornamentals and vegetables. Cereal and forage crop programs emphasize winter cereals. The station also operates programs on poultry nutrition; on crop protection against pests including studies on plant pathology, insect pests and herbicides; and on fruit and vegetable storage and processing.

ENERGY, MINES AND RESOURCES CANADA

Cape Breton Coal Research Laboratory
201 George Street, Sydney, Nova Scotia B1P 1J3
Contact: D.B. Stewart, Laboratory Director, Tel: (403) 987-8215
Personnel: Total is 20.
Activities: The Cape Breton Coal Research Laboratory was established as part of CANMET's continuing program in response to a recommendation of the Elfstrom Commission's report on the multiple fatalities in No. 26 Colliery at Glace Bay, N.S. The objectives of the R&D program are the establishment of safe, efficient mining techniques for local use, to develop a program for effective underground explosion control and to assist in the development and implementation of new techniques underground. The laboratory is moving towards its full complement. The initial phases of two underground experimental programs in underground strata control and ventilation system analysis are underway and have been coordinated with Cape Breton Development Corporation. Plans for the use of a prototype Canadian tunnel boring machine currently under construction in Toronto include performance evaluations by staff of the laboratory. All three laboratories (Cape Breton, Edmonton and Calgary) have a common emphasis on field oriented R&D programs that are frequently carried out in conjunction with industry at the industrial partner's operating mine or coal preparation plant. Support from the divisional laboratory bench activities and, on occasion, from other divisions of CANMET contribute to the success of the field activities.
Facilities: Open Jet Wind Tunnel for Anemometer Calibration; Dasella Gravimetric Dust Sampler; Automatic Surface Grinder with Magnetic Chuck.

Geological Survey of Canada - Atlantic Geoscience Centre
P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2
Contact: M.P. Petre, Program Officer, Tel: (613) 995-4214
Personnel: Total is 116.
Activities: The Atlantic Geoscience Centre is located at Bedford Institute of Oceanography. Research is concerned with geological and geophysical studies of the continental margins of Eastern and Arctic Canada and contiguous ocean basins; Geology of the sedimentary basins along the eastern Canadian seaboard including Bay of Fundy, Gulf of St. Lawrence, Hudson Bay, Baffin Bay and the entire adjacent Atlantic shelf; Marine geological and geophysical mapping; Experimental and theoretical studies on the development of continental margins; Petroleum geology; Coal petrology, Surficial and environmental marine geology including Quaternary stratigraphy and glacial history, seabed stablity and marine geotechnics, sedimentology of coastal and marine sedimentary environments, inorganic and organic geochemistry. Technology development, e.g., ocean bottom seismometers. Developments in management of geological, paleontologial and geophysical data. Topics of particular current interest include geophysical modelling of the development of sedimentary basins; studies of seabed stability on the continental shelf and slope; seismicity of passive margins.
Facilities: Marine Geophysical, Geological Survey and Data Processing Equipment including mini-computers, microprocessors and access to BIO mainframe; equipment for geochemistry and paleontology labs, instrument and electronic shops.

ENVIRONMENT CANADA

Atmospheric Environmental Service: Atlantic Region
1496 Bedford Highway, 6th Floor, Bedford, Nova Scotia B4A 1E5
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 233.

Activities: Provision of meteorological services to the provinces of New Brunswick, Nova Scotia, Newfoundland and Prince Edward Island.
Facilities: Weather radar; Satellite receiving equipment; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

Environmental Protection Service: Dartmouth
45 Alderney Drive, Dartmouth, Nova Scotia B2Y 2N6
Contact: E.J. Jennex, Regional Finance Officer, Tel: (902) 426-5896
Personnel: Total is 88.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.
Facilities: 2 A.A. Spectrophotometers; 6 Gas Chromatographs; Infrared Spectrophotometer; Fluorescence Spectrophotometer; 2 U/V Visible Spectrophotometers; ICAP Emission Spectrophotometer; G.C. Mass Spectrophotometer; Ion Chromatograph.

Inland Waters Directorate - Atlantic Region
45 Alderway Drive, Dartmouth, Nova Scotia B2Y 2N6
Contact: S. Fenety, Acting Director, Tel: (902) 426-6050
Personnel: Total is 80.
Activities: Water management, water data gathering, water investigations, socio-economic studies.

FISHERIES AND OCEANS

Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2
Contact: H.B. Nicholls, Head, Ocean Information Division, Tel: (902) 426-3246
Personnel: Total is 633.
Activities: Bedford Institute of Oceanography, owned and operated by Ocean Science and Surveys (DFO), is a multi-departmental, multi-disciplinary institute which not only undertakes a full spectrum of ocean research and service functions for the East coast and Arctic, but also has a significant role in international marine science activities. Client sectors include defence, marine transportation, energy, fisheries, environment, industrial development and recreation. OSS components are Atlantic Oceanographic Laboratory (physical and chemical oceanography and ocean instrumentation), Marine Ecology Laboratory (biological oceanography and environment/community studies) and Canadian Hydrographic Service (chart production and navigation).
Facilities: In addition to a fleet of ships and launches, BIO has much special equipment, including prototypes (in-house designs), ranging from satellite reporting data collection packages and navigation systems to sensitive advanced sonar for study of marine communities.

Fisheries Research Branch - Scotia Fundy Region
P.O. Box 550, Halifax, Nova Scotia B3J 2S7
Contact: Dr. J.E. Stewart, Research Director, Tel: (902) 426-3130
Personnel: Total is 330.
Activities: Research programs focus on the life history, ecology, population dynamics, species-interactions and stock assessments of the major finfish, shellfish and marine plant and marine mammal species of the region. Environmental studies are also conducted on fish and shellfish with emphasis on disease, nutrition, growth, physiology and effects of contaminants, including sublethal effecs of pollutants on commercially important finfish and invertebrates and their environment. There are additional programs in endocrinology, genetics and physiology in support of fisheries resource management and development. Field-oriented research programs are directed to studies on population assessments, exploitation, growth, angling harvest and spawning success of freshwater and anadromous species, particularly Atlantic salmon in Nova Scotia and southern New Brunswick. In addition, salmon enhancement programs involving biological investigations, engineering technology and fish culture operations are conducted to expand and rehabilitate stocks in selected rivers and lakes. Applied research is conducted on environmental factors (including acidification) impacting on the habitat of freshwater dependent species.

NATIONAL DEFENCE

Defence Research Establishment: Atlantic
P.O. Box 1012, Dartmouth, Nova Scotia B2Y 3Z7
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 205.
Activities: DREA, located in Dartmouth, Nova Scotia, is a Maritime laboratory concerned with research related to the problems of anti-submarine defence in the North Atlantic including underwater acoustics, signal processing, transducer research, hydronautics and materials research.

Facilities: Research Vessel - CFAV Quest.

NATIONAL RESEARCH COUNCIL CANADA

Atlantic Research Laboratory
1411 Oxford Street, Halifax, Nova Scotia B3H 3Z1
Contact: Not Available.
Personnel: Total is 85.
Activities: Established to complement as well as to assist other research facilities in the region, the laboratory program relates to building fundamental knowledge bases in areas relevant to the Atlantic region's economy. The main thrusts of the Laboratory's research are in four areas: marine plants, particularly algae; marine analytical chemistry, including the development of methods and reference samples for measuring minute quantities of toxic substances in sea water, sediments, and marine plants and animals; research in support of agriculture, including the effects of soil microbes on sheep and cattle growth; and research on extractive metallurgy and coal, including the chemical reactions occurring in the steel-making process.

Atlantic Regional Station
1411 Oxford Street, Halifax, Nova Scotia B3H 3Z1
Contact: Not Available.
Personnel: Total is 4.
Activities: The station's main role is to provide assistance to the construction industry in the Atlantic provinces by drawing on research, testing, and standards work done by IRC and other sources. It also provides IRC researchers in Ottawa with information on problems encountered in Atlantic Canada.

REGION C - PRINCE EDWARD ISLAND

AGRICULTURE CANADA

Research Station: Charlottetown
P.O. Box 1210, Charlottetown, Prince Edward Island C1A 7M8
Contact: Dr. L.B. Macleod, Director, Tel: (902) 892-5461
Personnel: Total is 111.
Activities: The research station at Charlottetown has the Atlantic Region responsibility for research on the production and utilization of livestock feed crops (forages, cereals, protein), tobacco, and certain vegetable crops grown for processing. Emphasis on potato research is in the area of nutrition and management for processing and table potatoes. Research is conducted on disease evaluation and control and postharvest testing by enzyme-linked immunosorbent assay (ELISA) for virus content of potatoes destined for domestic and export seed markets.

NATIONAL RESEARCH COUNCIL CANADA

Technical Information Service: Charlottetown
73 Rochford Street, Charlottetown, Prince Edward Island C1A 3T5
Contact: Not Available.
Personnel: Data not available.
Activities: Part of NRC's Field Advisory Service (see Industry Development Office - page XX).

REGION E - NEW BRUNSWICK

AGRICULTURE CANADA

Animal Pathology Laboratory: Sackville
P.O. Box 1410, Sackville, New Brunswick E0A 3C0
Contact: Dr. R.G. Stevenson, Director, Tel: (506) 536-0135
Personnel: Total is 19.
Activities: The laboratory is involved in bacteriological, histopathological and virological studies to improve diagnostic procedures in bovine/ovine, and poultry diseases; in studies on the pathogenesis of ovin pneumonia and in parasitological research on trichinosis in swine and other animals, including wild animals. Although research and diagnostic work is conducted on diseases of several animal species, emphasis is placed on ovidae. The diagnostic function is in support of the livestock industry and regulatory agencies.
Facilities: Titertek Multiscan MC (ELISA plate reader); Titertek Autodrop (Microplate dispenser); Titertek Microplate Washer (120); Hamilton Microlab 1000 (Digital Diluter).

Maritimes Forest Research Centre
College Hill, P.O. Box 400, Fredericton, New Brunswick E3B 5P7
Contact: Donald M. Thorpe, Regional Financial Officer, Tel: (506) 452-3557
Personnel: Total is 212.
Activities: The centre carries on a broad program of research in all forestry and forestry-related disciplines, seeking solutions for the major forest management problems in the Maritimes. There are nine active sub-programs, one dealing primarily with forest research and technical services and one with forestry development agreements. Research projects address several major problem areas including forest renewal, acid rain, forest productivity, spruce budworm, and other insects and diseases. The overall aim of the centre's program is to solve major forestry problems and develop more efficient management techniques for use by forest management agencies in the three Maritime Provinces.
Facilities: ICP Spectrometer with plasma and therm source; Acid rain misting chambers.

Research Station: Fredericton
P.O. Box 20280, Fredericton, New Brunswick E3B 4Z7
Contact: Dr. Y. Martel, Director, Tel: (506) 452-3260
Personnel: Total is 125.
Activities: The Fredericton research station maintains programs on production and improvement of horticultural crops. A multidisciplinary effort is directed to the development of production technologies for potatoes that will ensure the viability of the potato industry, improve the quality of seed potatoes and promote the seed export market. Research on potato breeding includes estimates of genetic parameters, and the use of Canadian germ plasm resources to broaden the genetic base. Integrated pest management is emphasized, as well as testing procedures for mycotoxins. Soil management and conservation studies include ongoing research on erosion control, drainage systems and subsoiling. Animal nutrition, the production of livestock feeds, forage and cereal crops, the handling and conservation of forage are carried out in close collaboration with Nappan Experimental Farm.

Senator Herve J. Michaud Experimental Farm
P.O. Box 667, Buctouche, New Brunswick E0A 1G0
Contact: Dr. G. Rousselle, Superintendent, Tel: (506) 743-2464
Personnel: Total is 10.
Activities: Work at this farm is concerned with response to the industry requirements of the Eastern New Brunswick coastal area, and with techniques for improving winter hardiness of apple trees and management of small fruit crops.

FISHERIES AND OCEANS

Fisheries Research Branch - Gulf Region
P.O. Box 5030, Memramcook, New Brunswick E0A 1X1
Contact: Mr. J.S. Loch, Research Director, Tel: (506) 857-6200
Personnel: Total is 98.
Activities: Research focuses both on marine and freshwater fisheries; cooperative studies are carried out with Maritime communities and other government laboratories. Programs underway include: marine fish and invertebrate stock assessments and biology; parasite studies; stock assessment and biology of salmon, gaspereau and eels, culture of marine molluscs and salmonids; impact of man's activities on marine and freshwater ecosystems; protection of habitats critical to the life cycle of important species. Field stations are located in Nova Scotia, Prince Edward Island, Newfoundland and New Brunswick both at freshwater and marine sites. Laboratory facilities are also located on the campus of the University of Moncton, University of Prince Edward Island, and at the Ellerslie Field Station.

St. Andrew's Biological Station
P.O. Box 5030, St. Andrew's, New Brunswick E0G 1X1
Contact: Dr. J.E. Stewart, Research Director, Tel: (902) 426-3130
Personnel: Data not available.
Activities: Research is divided into three broad categories. The first two divisions cover the marine vertebrate and invertebrate fisheries by conducting research into the biology and management of fisheries resources through studies of life history, ecology, behavior, population dynamics and stock assessment. The third broad category is one of environmental studies of the effects of

local industries and resource management practices, including the sublethal effects of pollutants on commercially important fish and invertebrates, their environment and the fisheries they support. There are additional programs based on endocrinology, genetics and physiology in support of resource management and development. The Biological Station is located on Passamaquoddy Bay. Research programs are also undertaken in collaboration with the Huntsman Marine Laboratory, and North Atlantic Salmon Research Centre.

REGION G - EASTERN QUEBEC

AGRICULTURE CANADA

Experimental Farm: Kamouraska
P.O. Box 400 La Pocatiere, Kamouraska, Québec G0R 1Z0
Contact: Mr. J.E. Comeau, Superintendent, Tel: (418) 856-3141
Personnel: Total is 40.
Activities: The experimental farm at LaPocatiere is responsible to the Research Station at Ste-Foy, Québec and carries out programs on cereals, forage crops, potatoes and tree fruits.

Experimental Farm: Normandin
1472 Saint Cyrville Street, Normandin, Québec G0W 2E0
Contact: M. J.M. Wauthy, Superintendent, Tel: (418) 274-3378
Personnel: Total is 28.
Activities: The experimental farm at Normandin is responsible to the Research Station at Ste-Foy, Québec and carries out programs concerned with evaluating lines and varieties of forage crops, cereal crops, and some small fruits.

Laurentian Forest Research Centre
1055 rue du P.E.P.S., C.P. 3800, Ste-Foy, Québec G1V 4C7
Contact: Nicole Gaudreault, Financial Analyst, Tel: (514) 648-5260
Personnel: Total is 121.
Activities: Systems analysis applied to forestry and related disciplines and computer simulation models including optimization by dynamic programming, of individual trees, stands, and of management strategies. Remote sensing as related to forest stand inventory. Insect pathology; epidemiology, ecology, population dynamics and biological control of forest insects, particularly the spruce budworm and the gypsy moth.

Research Station: Ste-Foy
2560 Hochelaga Boulevard, Ste-Foy, Québec G1V 2J6
Contact: S.J. Bourget, Director, Tel: (418) 694-4814
Personnel: Total is 90.
Activities: This research station, located near the campus of Laval University, is responsible for research aimed at overcoming problems associated with the production of forage and cereal crops in Québec and other parts of Eastern Canada. Attention is given to grasses and legumes, especially timothy and alfalfa; to cereals, notably oats and barley; to soil management, particularly the fertility and drainage requirements of low lying alluvial soils; and to insect, disease and physiological problems associated with crop production, with special emphasis on research on factors contributing to winter hardiness.

FISHERIES AND OCEANS

Champlain Centre for Marine Science and Surveys
P.O. Box 15,500, 901 Cap Diamant, Québec City, Québec G1K 7Y7
Contact: Marc Journault, Acting Chief, Program Analysis and Scientific Information, Tel: (418) 648-5795
Personnel: Total is 80.
Activities: The activities of the Champlain Centre for Marine Sciences and Surveys are performed in the oceanographic and hydrographic areas. The oceanographic group can be divided into three fields of specialized research as follows: biological oceanography, with a mandate aiming for a better comprehension of the coasts and estuaries ecosystems; chemical oceanography, with a mandate for the preservation of the marine resources and the quality of waters under regional jurisdiction; physical oceanography, obtaining a better comprehension of the circulation of the mixed costal waters in contact with an influx of soft water from the Gulf of St. Lawrence estuary and the nordic waters along Québec. On the other hand, the Hydrographic Service of Canada has a mandate to collect hydrographic data (bathymetrics, tidegraphics, currents data, etc.) to produce the marine maps necessary for maritime navigation. A section of research and development within the HSC has a mandate to develop and implement new technologies applicable to the area of hydrographic study.
Facilities: Positional system - Syledis SR3; Electromagnetic currentometers - MARSH McBirney; Teledetection detector - MEISS.

Fisheries Research Branch - Québec Region
Gare Maritime Champlain, P.O. Box 15,500, 901 Cap Diamant, Québec City, Québec G1K 7X7
Contact: Dr. J. Boulva, Research Director, Tel: (819) 648-3543
Personnel: Total is 74.
Activities: Research focuses on marine fisheries, and studies are often carried out in cooperation with Québec universities or other government laboratories. Programs are underway in the following areas: stock delineation and assessment, and determination of yields for exploited stocks; life cycle and ecology of fish, invertebrate and marine mammal species of the Gulf of St. Lawrence and St. Lawrence estuary; structure and dynamics of marine ecosystems in the same areas; impact of man's activities (eg. pollution, hydroelectric development) on marine ecosystems; and protection of habitats critical to the life cycle of important species. Laboratory facilities are also located at the University of Rimouski.

Arctic Biological Station
Gare Maritime Champlain, P.O. Box 15,500, 901 Cap Diamant, Québec City, Québec G1K 7X7
Contact: Dr. J. Boulva, Research Director, Tel: (819) 694-3478
Personnel: Data not available.
Activities: The laboratory facilitates life history, ecology and population dynamics of marine mammals in arctic and eastern Canadian waters and of marine and anadromous fishes of the arctic and subarctic, and the effects of environmental disturbance on these animals. Productivity of benthos, plankton and fish is used in assessing the effects of man's activities on the arctic marine environment. Physiological studies on marine invertebrates and evaluation of the effects of arctic crude oils on the invertebrate fauna are conducted, as well as assessment of seasonal fluctuation of microbial flora in northern marine waters and their ability to degrade arctic crude oils.

NATIONAL DEFENCE

Defence Research Establishment: Valcartier
P.O. Box 880, Courcellete, Québec G0A 1R0
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 621.
Activities: DREV, located adjacent to CFB Valcartier near Québec City, conducts research in the fields of armaments, electro-optical aspects of surveillance and remote sensing, command and control, propellants, explosives, areospace, lasers and weapon systems analysis.
Facilities: Mobile Lab - CO2 Laser Experiments; Pilot Plant - propellants and explosives.

NATIONAL RESEARCH COUNCIL CANADA

Institute for Research in Electrochemistry
Shawinigan, Québec G9N 1X1
Contact: Not Available.
Personnel: Total is 0.
Activities: Work at this Institute will include all aspects of applied electrochemistry - from basic studies of material properties and design of electrolysis cells and storage batteries, through manufacturing, testing and analysis, to the eventual transfer of technology to Canadian industry.

Technical Information Service: Ste-Foy
333 Franquet Street, P.O. Box 9038, Ste-Foy, Québec G1P 4C7
Contact: Not Available.
Personnel: Data not available.
Activities: Part of NRC's Field Advisory Service (see Industry Development Office - page XX).

TRANSPORT CANADA

Hydraulics Research Centre
Lasalle, Québec G1X 1X1
Contact: C.J.R. Lawrie, Chief, Waterways Development, Tel: (613) 990-5617
Personnel: Total is 8.
Activities: The Canadian Coast Guard's Hydraulics Research Centre is utlized by research engineers to conduct in-house studies in establishing safe and efficient channel conditions for navigation in Canadian waterways. Investigations are conducted on scale models simulating the site and vessel conditions to be studied. In general, these studies are oriented by the departments regulatory and operational responsibilities, and they relate to existing conditions or proposed developments. Some of the research programs in progress or being planned are: the investigation of methods of protecting bridge piers in navigable waters; study of buoy mooring forces; determination of loss of speed/power of vessels navigating in ice-infested waterways; and testing of large vessel manoeuvrings in restricted waterways.

REGION H - METROPOLITAN MONTREAL

DEPARTMENT OF COMMUNICATIONS

Canadian Workplace Automation Research Centre
1575 Chomodey Boulevard, Laval, Québec H7V 2X2
Contact: Daryl Leitch, Financial Analyst, Tel: (613) 990-4665
Personnel: Total is 15.
Activities: The CWARC is devoted exclusively to R&D in all aspects of office automation. The R&D program will be centered around the broad topic of work place automation including the technological, socio-economic, behavioural, institutional and international aspects. More specifically, it will ensure that the necessary technology is available at the appropriate time, ensure that Canadian universities take an active interest in the field in order that a flow of trained skilled people will be available to meet Canadian needs; ensure that the social, behavioural and institutional impact of the introduction of the new technologies is investigated; maintain an awareness of developments on the international scene; and advise industry and governments on developments and possible actions.

ENVIRONMENT CANADA

Atmospheric Environmental Service: Québec Region
100 Alexis Nihon Boulevard, 31st Floor, St. Laurent, Québec H4M 2N6
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 222.
Activities: Provision of meteorological services to the province of Québec and the Eastern part of the Northwest Territories.
Facilities: Weather radar; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

Canadian Meteorological Centre
2121 North Service Road, Suite 404, Dorval, Québec H9P 1J3
Contact: S.J. Lemire, Director, Tel: (514) 683-7274
Personnel: Total is 146.
Activities: Not available

Environmental Protection Service: Montréal
1550 Maisonneuve Boulevard, Montréal, Québec H3G 1N2
Contact: Christian Blaise, In Charge of Research, Tel: (514) 651-6860
Personnel: Total is 49.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.

NATIONAL FILM BOARD

Technical Research Division
3155 Côte de Liesse Road, St. Laurent, Québec H4N 2N4
Contact: Eddy Zwaneveld, Director, Technical Research, Tel: (514) 283-9143
Personnel: Total is 947.
Activities: Research is directed towards making the NFB a centre for applied technical research and for the technical and artistic development of audiovisual communication. New impetus is being given to the applied research program and the modernization of facilities to meet the highest technical standards. Plans include the creation of a "Centre d'animatique" where all research on computer assisted animation will be collected. Some 50 research projects are presently underway in response to current production needs.
Facilities: Motion picture and video equipment.

NATIONAL RESEARCH COUNCIL CANADA

Biotechnology Research Institute
Montréal, Québec H1X 1X1
Contact: Not Available.
Personnel: Total is 28.

Activities: This institute will contribute to the creation, development, understanding and diffusion of new knowledge in biotechnology in order to create employment, increase productivity and raise Canadian industry's competitive position in the world. Main areas of research are to include fermentation and biochemical and process engineering, genetic engineering, cell fusion, and enzyme technology.

Energy Division
Montréal, Québec H1X 1X1
Contact: Not Available.
Personnel: Total is 1.
Activities: Not available

REGION J - WESTERN QUEBEC

AGRICULTURE CANADA

Animal Pathology Laboratory: St-Hyacinthe
3000 Sicotte Street, St-Hyacinthe, Québec J2S 2L8
Contact: Dr. André N. Gagnon, Director, Tel: (514) 773-7730
Personnel: Total is 14.
Activities: Over the next three years (1985-1988), the laboratory will be completely reorganized. At present, its activities are confined to certain diagnostic procedures for the detection of bacterial contamination in meat and meat products and support for some eradication and exploration programs. In the medium term, the laboratory will be assigned additional responsibilities involving research primarily in the area of porcine diseases.

Experimental Farm: L'Assomption
P.O. Box 1070, L'Assomption, Québec J0K 1G0
Contact: M. F. Darisse, Superintendent, Tel: (514) 589-4775
Personnel: Total is 31.
Activities: The experimental farm at L'Assomption and its sub-station at Lavaltrie, are concerned with the production of cigarette and cigar tobacco. Research on ornamental trees and shrubs is also conducted at L'Assomption, and the farm collaborates with the St-Jean Station in the production of insect and disease-resistant strains of corn grown for grain.

Food Research Station
3100 Laframboise Boulevard, Suite 103, St-Hyacinthe, Québec J2S 4Z4
Contact: Dr. R.R. Riel, Director, Tel: (514) 773-5771
Personnel: Total is 11.
Activities: The Centre's program focusses on the development of new processes and improved methods in their application to milk, meat, cereals, oilseeds, fruits, vegetables, eggs and beverages. Special attention is given to biotechnology, irradiation, fermentation, extraction and fractionation of biological materials. There is emphasis on the study of new ingredients, new food concepts, new equipment and new packaging and preservation techniques.
Facilities: There are laboratories for the basic food disciplines and also six major pilot plants oriented towards food engineering, biotechnology, aromas and extraction, irradiation, cheeses and general. These facilities are accessible to researchers from the food industry or other organizations to do their own research and development.

Production Development Directorate - New Crop Development Fund
200 Sacre Coeur Boulevard, Hull, Québec J8X 4C6
Contact: Joan Vandenburg, Director - Crop Production Division, Tel: (613) 994-0086
Personnel: Total is 5.
Activities: The New Crop Development Fund (NCDF) is intended to focus on projects which attempt to demonstrate the commercial potential of new crops, new varieties, new technology and/or new production practices to a region. The Fund is intended to be flexible enough to respond to developments in research, technology and market conditions. Eligible applicants are commercial organizations, industrial or producer organizations, universities or other non-profit organizations and provincial or territorial agencies. Assistance is in the form of financial contributions which are subject to specified conditions and management advice for the project. Proprietary rights to the results of any research accrues to the Crown.

Research Station: Lennoxville
P.O. Box 90, Lennoxville, Québec J1M 1Z3
Contact: Dr. J.C. St. Pierre, Director, Tel: (819) 565-9171
Personnel: Total is 98.
Activities: Research focuses on the production aspects of dairy cattle, beef cattle, swine and sheep, and on the production and utilization of forage crops. Genetic and physiological research is aimed at increasing the reproduction rate of beef cows through crosses with beef and dairy breeds, by reducing calving complications and by stimulating multiple ovulations through better feeding. In swine, work is done on reproductive physiology and in sheep, the researchers seek to lengthen the mating period through selection, in order to obtain two litters per year. Research is also underway on the production of forages, soil fertility and soil physics as well as the agronomic value of animal waste for better disposal by land applications.

Research Station: St-Jean-sur-Richelieu
P.O. Box 457, St-Jean-sur-Richelieu, Québec J3B 6Z8
Contact: Dr. C.B. Aubé, Director, Tel: (514) 589-4775
Personnel: Total is 89.
Activities: The research station is situated south of Montreal and offers favourable conditions for the production of horticultural crops, corn and tobacco. Research programs are oriented to the production and protection of vegetables, tree fruits and small fruits as well as herbs and corn, all of which contribute to the economic development of Québec. The following sub-stations provide the St-Jean research station with facilities for field work for fruit, market-garden crops, and legumes, respectively: Frelighsburg, Québec, J0J 1C0; Ste-Clothilde, Québec, J0L 1W0; L'Acadie, 280 Montee Paradis, Québec, J0J 1H0.

NATIONAL RESEARCH COUNCIL CANADA

Industrial Materials Research Institute
75 De Mortagne Boulevard, Boucherville, Québec J4B 6Y4

Contact: Not Available.
Personnel: Total is 107.
Activities: This institute is carrying out industrially-relevant research on materials such as glass, ceramics, concrete and plastics. Research ranges from laboratory-scale experiments to pilot plant-scale projects.

TRANSPORT CANADA

Motor Vehicle Test Centre
P.O. Box 285, Blainville, Québec J7E 4J2
Contact: Mr. Galarneau, Director, Tel: (514) 430-7981
Personnel: Total is 34.
Activities: Maintains physical facilities and provides some motor vehicle testing services for the Road Safety and Motor Vehicle Regulation Directorate of Transport Canada, and for other public and private sector clients.
Facilities: High and low speed tracks; Vehicle dynamics test area; Brake test area; Crash test barrier; Large and small cold chambers; Chassis dynamometers; Emission analysis bench; Pendulum test device; Roof crush test device.

REGION K - EASTERN ONTARIO

AGRICULTURE CANADA

Animal Diseases Research Institute: Nepean
801 Fallowfield Road, P.O. Box 11300, Nepean, Ontario K2H 8P9
Contact: Dr. Barry Stemshorn, Director, Tel: (613) 998-9320
Personnel: Total is 217.
Activities: This institute has expertise in the disciplines of veterinary microbiology, immunology, pathology, and reproductive pathophysiology. Basic and applied research is conducted to improve the diagnosis, prevention and/or control of zoonotic and foreign animal diseases such as rabies, brucellosis, African swine fever and bluetongue. Also studied are selected indigenous diseases which cause high losses to productivity or impede international trade opportunities. The institute conducts laboratory tests to support national disease control and eradication programs, to support the international export of Canadian livestock, to prevent entry of foreign animal diseases into Canada and to certify the parentage and blood type of cattle and horses. It is the national centre for foreign animal disease diagnosis and produces diagnostic reagents used in Canada and internationally for livestock disease diagnosis.
Facilities: One 10-year old transmission EM; High performance (pressure) liquid chromatograph (HPLC); Biological containment facilities suitable for work on Brucella, TB, Rabies, etc.; Fermentation equipment; Micromanipulation and freezing equipment for work with embryos; Equipment for electrophoresis, immuno-electrophoresis and isoelectric focusing (includes poly-acrylamide gels, immuno-blots, Nucleic acid electrophoretic analyses); Computerized systems for reading and analyzing results of enzyme immunoassays; Biological containment facilities (MRC levels D and C) for laboratory animals, livestock and veterinary biologics production.

Animal Research Centre
Ottawa, Ontario K1A 0C6
Contact: Dr. R.S. Gowe, Director, Tel: (613) 993-6002
Personnel: Total is 270.
Activities: Research at the Animal Research Centre is mission oriented and is directed toward solving high priority problems arising from domestic animal and poultry production and to developing advanced systems to meet future trends within the Canadian animal agricultural industry. The Centre's chemical laboratories and administrative headquarters are located on the Central Experimental Farm. On the 1200 hectare Research Farm, in the Ottawa suburbs, modern facilities are available to house dairy cattle, sheep, swine, poultry and various laboratory animals as required for extensive and intensive research by a multidisciplinary staff of 50 scientists. In addition a feed mill and facilities for surgery and radioisotope use with large animals are available. Programs include the study of problems of intensively housed and managed livestock and poultry; research on feedstuff contaminants (mycotoxins); application of biotechnology in agricultural production. High priority is placed on the transfer of research results from the laboratory to the farmer-user.

Biosytematics Research Institute
K.W. Neatby Building, Carling Avenue, Ottawa, Ontario K1A 0C6
Contact: Mr. G.A. Mulligan, Director, Tel: (613) 996-1665
Personnel: Total is 125.
Activities: The institute provides the National Identification Service for insects, fungi, arachnids, nematodes, and vascular plants, this is utilized by clients throughout Canada. Extensive research is conducted in biosystematics, taxonomy, faunistics, floristics, and evolution. The institute is the custodian of the National Collection of Insects and Arachnids, the National Mycological Herbarium, the Canadian National Collection of Nematodes, and CDA Vascular Plant Herbarium. Excellent library facilities particularly in the area of plant, insect, arachnid, and nematode systematics are available.

Chemistry and Biology Research Institute
K.W. Neatby Building, Carling Avenue, Ottawa, Ontario K1A 0C6
Contact: Dr. I. de la Roche, Director, Tel: (613) 995-5287
Personnel: Total is 94.
Activities: Present research objectives are concerned with the development of effective and environmentally acceptable methods of weed and fungus control by pesticides; the development of analytical methodology to establish safe levels of fungal toxins in food and feedstuffs and to provide effective measures of decontamination and control; the increase of the nitrogen-fixing capability of forage legumes through selection and genetic engineering of the bacterial symbiont and host improvement; the epidemiology and transmission of virus and mycoplasma diseases of plants in relation to disease incidence, management and control; the efficient use of soil nitrogen; the prevention of soil organic matter losses, and the minerology of Canadian soils; the provision of new knowledge on the mechanisms of cold acclimation, freezing injury and overwintering damage in relation to the development of crop plants, resistant to environmental stresses. The Institute also provides a comprehensive electron microscope service, analytical chemistry service, and mineral analyses service for Research Branch establishments across Canada.

Engineering and Statistical Research Institute
Building # 94, Central Experimental Farm, Ottawa, Ontario K1A 0C6
Contact: Mr. P. Voisey, Director, Tel: (613) 995-5179
Personnel: Total is 97.
Activities: The institute provides services in engineering and biometrics. Research is carried out in five main areas: BIOMETRICS - experimental design, statistical analysis, software development and interpretation of data; AGRICULTURAL ENGINEERING - restricted to mechanization of minor horticultural crops and design of farm buildings (development of a range of machines for farm use); ENERGY ENGINEERING - for the conservation and production of energy across the agrifood system, primarily by contracting-out R&D; FOOD ENGINEERING - to develop new unit processes and equipment to improve production efficiency and quality, particularly for new commodities; ENGINEERING DEVELOPMENT - of new equipment for research and food inspection operations. The institute provides advice in these areas and on a wide range of

problems in engineering and statistics. Spectroscopic equipment has been developed and applied to remote sensing of biological phenomena. A spectroradiometer for individual plant studies and an open path CO2 greenhouse control have been developed.

Food Research Institute
Central Experimental Farm, Ottawa, Ontario K1A 0C6
Contact: Dr. N. Tape, Director, Tel: (613) 995-5362
Personnel: Total is 65.
Activities: FRI is the largest public sector establishment dedicated to food research. Research programs are in effect in the following areas: Processing Technology - Effects of processing on the chemical and physical properties of foods; sensory and objective evaluation of foods; functional properties of food ingredients; microstructure of foods; chemistry of food carbohydrates, polysaccharides, proteins and lipids; mechanisms of thermal, chemical and enzymatic gelation. Ingredients and New Product Development - Isolation and characterization of components from agricultural raw materials; innovations in food processing techniques; development of new processes to prepare food ingredients and prototype food products. Food Safety and Nutrition - Microbial populations in cured meats; mechanisms of nitrite action in meats; qualitative and quantitative analysis of vitamins and nutrients of food and food ingredients; control of micro-organisms in relation to the quality, safety and preservation of foods; effects of processing on the nutritive value of foods.

Grains Group
235 Queen Street, Ottawa, Ontario K1A 0G2
Contact: R.H.M. Cathcart, Executive Secretary, Tel: (613) 995-7127
Personnel: Total is 1.
Activities: MARKETING: Study and development of more effective and economic methods for moving, storing, processing and selling Canadian grains and oilseeds; development and administration of programs for preparing production guidelines; establishment of initial payments for Canadian Wheat Board grains; provision of marketing and industrial development assistance; and participation in the work of international and domestic organizations concerning grains and oilseeds, the operation of the office of the Minister of State for the Canadian Wheat Board and the special group on grains. GRAINS PAYMENTS: Payments to the Canadian Wheat Board of interest on cash advances on farm stored grain made to producers in Western Canada; reimbursement to the Canadian Wheat Board when grain producers default on repayment of cash advances, under terms of the Prairie Grain Advance Payments Act; reimbursements to the Canadian Wheat Board where necessary under the terms of the Canadian Wheat Board Act for deficits incurred on the Canadian Wheat Board pool accounts, and payments in connection with the Western Grain Stabilization Act.

Laboratory Services Division
Building 22, C.E.F., Ottawa, Ontario K1A 0C6
Contact: Dr. W.P. Cochrane, Director, Tel: (613) 995-4907
Personnel: Total is 119.
Activities: This laboratory provides physical, chemical and biological testing services in support of inspections, quality and safety assurance programs of the Food Protection and Inspection Branch on food products (meat, egg, dairy, fruit and vegetable products) and agricultural inputs (feeds, fertilizers, seeds and pesticides). Analytical methodology research is conducted in order to maintain state-of-the-art quality service on a timely and reliable basis.
Facilities: High and low resolution GC/Mass Spectrometers for low level micro-contaminant analysis of residues.

Land Resource Research Institute
K.W. Neatby Building, Carling Avenue, Ottawa, Ontario K1A 0C6
Contact: Dr. J.S. Clark, Director, Tel: (613) 995-5011
Personnel: Total is 170.
Activities: The Land Resource Research Institute (LRRI) has responsibility for national programs in land resources and agrometeorologic services. The programs of the institute include the national soil survey program, a supporting program in soil classification research, a program involving studies in land evaluation agricultural land use and soil degradation, and an agrometeorological program that includes agrometeological services, farm weather service, crop-weather modelling, and crop information. The institute is organized on a regional basis, with soil survey units located in each of the provinces where cooperative survey work is carried out. The central group in Ottawa is responsible for national correlation and map production, and research in the various aspects of soil, water, and agrometeorological disciplines.

Petawawa National Forestry Institute
Chalk River, Ontario K0J 1J0
Contact: James McManus, Financial Officer, Tel: (613) 995-7010
Personnel: Total is 131.
Activities: To develop, demonstrate and promote the use of practical means of establishing and managing forests, and practical means of enhancing the growth and quality of forests; to develop knowledge and techniques to assist forest management agencies and reduce wildfire losses and utilize prescribed fire in a safe and ecologically sound manner; responsible for the acquisition, summary and publication of forest resource data at the national level. Dedicated to improving and expanding the information available on the forest resource, and to developing efficient methods for that purpose.

Research Station: Ottawa
Ottawa, Ontario K1A 0C6
Contact: Dr. I. de la Roche, Director, Tel: (613) 995-8775
Personnel: Total is 208.
Activities: The Ottawa research station is the major centre for plant breeding in eastern and central Ontario. It is a major centre for ornamentals biotechnology for crop improvement, and integrated management of alfalfa pests. A small unit is engaged with studies of honeybee behavior and pathology. The central office for the Canadian Plant Gene Resources is also

part of the station. The management of the Central Experimental Farm, including numerous services, is also the Station's responsiblity. The breeding programs are supported by multidisciplinary research in plant, molecular genetics, cytogenetics, plant physiology and pathology, entomology, cytochemisty, and grain quality. Specific programs emphasize experimental haploidy, tissue-culture genetics, cytology, insect pest management and honeybee pheromones, attractants and diseases.

Smithfield Experimental Farm
P.O. Box 340, Trenton, Ontario K8V 5A5
Contact: Dr. R.S. Miller, Superintendent, Tel: (613) 392-3527
Personnel: Total is 23.
Activities: Smithfield Experimental Farm is administratively linked to the Vineland Research Station and carries on horticultural production and processing research, as well as pest control research programs in cooperation with Vineland.

ATOMIC ENERGY CONTROL BOARD

270 Albert Street, Ottawa, Ontario K1P 5S9
Contact: Mrs. K. Bryant, Financial Planning and Systems Officer, Tel: (613) 995-6408
Personnel: Total is 285.
Activities: Administration of Atomic Energy Control Regulations - The making of regulations for developing, controlling, supervising, and licencing the production, application and use of atomic energy; the regulating of mining, refining production, processing, import, export, transport, possession, ownership, use or sale of prescribed substances; the defining of standards to be met, the assessing of the capabilities of licence applicants to meet these standards and to assure their maintenance, and the inspecting to ensure compliance; the conducting of mission-oriented research and development to obtain data essential for the effective implementation of licensing and compliance activities; and the designating, under the Nuclear Liability Act, of nuclear installations and the prescribing of the basic insurance to be carried by the operators of such installations, the developing of specialized safeguards, techniques and equipment in respect of CANDU reactors in Canada and abroad, in cooperation with Atomic Energy of Canada Limited and the International Atomic Energy Agency in accordance with the Treaty on the Non-Proliferation of Nuclear Weapons.

ATOMIC ENERGY OF CANADA LIMITED

Chalk River Nuclear Laboratory
Chalk River, Ontario K0J 1J0
Contact: Stephen Hall, Program Officer, Tel: (613) 236-6444
Personnel: Total is 2377.
Activities: Programs cover a wide range of topics associated with atomic power. Work on basic physics, chemistry, materials science, and biology provides fundamental support to all aspects of nuclear technology and serves a national laboratory role in the nuclear sciences. CRNL supports the near-term needs of CANDU reactors by research programs on component development, systems chemistry, fuel behavior, heat transfer, reactor control and instrumentation, and fuel channel behavior. There is also development work to demonstrate that low and intermediate-level radioactive wastes arising from reactor operation can be immobilized in a stable form before disposal in a repository. Long-term needs of nuclear power are addressed by development of advanced nuclear fuel cycles and the development of accelerator technology.
Facilities: NRX Reactor; NRU Reactor; Tandem Accelerator Superconducting Cyclotron (under construction); Tritium Extraction Plant (under construction); Computing Centre.

CANADIAN DAIRY COMMISSION

2197 Riverside Drive, Ottawa, Ontario K1A 0Z2
Contact: Rowan Lalonde, Director Domestic Marketing, Tel: (613) 998-9490
Personnel: Total is 1.
Activities: Give contractual research to Canadian Industries and Universities in order to increase the consumption and utilization of dairy products.

CANADIAN INTERNATIONAL DEVELOPMENT AGENCY

200 Promenade du Portage, Place du Centre, Hull, Québec K1A 0G4

Contact: D.R. Warner, Planning Support Officer, Tel: (819) 994-4227
Personnel: Total is 16.
Activities: The objective of CIDA is to facilitate the efforts of the peoples of developing countries to achieve self-sustainable economic and social development in accordance with their needs and environment, by cooperating with them in development activities; and to provide humanitarian assistance thereby contributing to Canada's political and economic interest abroad in promoting social justice, international stability and long-term economic relationships, for the benefit of the global community.

CONSUMER AND CORPORATE AFFAIRS CANADA

Patent Office
Place du Portage, Phase 1 - 50 Victoria Street, Hull, Québec K1A 0C9
Contact: Mart Leesti, Deputy Director General, Tel: (613) 997-1057
Personnel: Total is 267.
Activities: The responsibility of the Patent Office is the granting of patents, the acquisition and dissemination of technological information and the encouragement of the creation, adoption and exploitation of inventions.

DEPARTMENT OF COMMUNICATIONS

Communications Research Centre
P.O. Box 11490, Station H, Ottawa, Ontario K2H 8S5
Contact: Daryl Leitch, Financial Analyst, Tel: (613) 990-4665
Personnel: Total is 473.
Activities: To advance Canada's research and development in the areas of telecommunications, space and information science and technology.

DEPARTMENT OF REGIONAL INDUSTRIAL EXPANSION

235 Queen Street, Ottawa, Ontario K1A 0H5
Contact: Not Available.
Personnel: Total is 198.
Activities: Not available

ENERGY, MINES AND RESOURCES CANADA

Canada Centre for Remote Sensing
2464 Sheffield Road, Ottawa, Ontario K1V 0X7
Contact: L. Whitney, Planning Advisor, Tel: (613) 993-0121
Personnel: Total is 129.
Activities: Improve remote sensing technology and facilitate the acquisition and dissemination of remote sensed data from aircraft and satellites.
Facilities: Satellite receiving ground stations, image analysis systems, special purpose production systems with specially designed hardware interfaces.

Canadian Explosive Atmospheres Laboratory
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Mr. J.A. Bossert, Manager and Certification Officer, Tel: (613) 996-4570
Personnel: Total is 13.
Activities: Research into explosion and fire safety in atmospheres containing explosive gases, vapours and dusts that occur in underground coal mines. Certification and testing services for electrical and diesel explosion proof equipment, and fire-resistant materials used in underground mines and similar applications.
Facilities: Test Facilities for: Atmospheric explosion tests, engine load tests (400HP), exhaust emissions analysis, intrinsic safety tests, gas detection tests, fire-resistant tests for conveyor belts, electric cables, pipes and dusts and hydraulic fluids.

Canadian Explosives Research Laboratory
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Mr. R.R. Vandebeek, Manager, Tel: (613) 996-4570
Personnel: Total is 16.
Activities: Certifies explosives submitted for authorization under the Canadian Explosives Act, investigates accidents involving explosives, provides technical advice on and advances technology related to the manufacture, storage, transportation and use of explosives.
Facilities: Includes large scale tanks to determine properties of explosives, friction and impact tests, dust explosibility equipment, accelerating rate calorimeter for thermal stability studies of energetic methods.

Combustion and Carbonization Research Laboratories
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Mr. G.K. Lee, Manager, Tel: (613) 996-4570
Personnel: Total is 54.
Activities: The work of this laboratory includes initiatives in combustion from domestic furnaces and wood stoves to the burning of low grade and hybrid fuels using conventional and fluidized bed technologies, as well as research on the treatment and carbonization of coal for coke-making. Work is also done on the preparation of coal feedstock for synfuels and combustion research. This laboratory provides technical support for demonstration by other departments including support for the Coal Branch demonstrations in coal-water mixtures, fluidized bed, etc.
Facilities: Fluidized bed pilot plant; boilers; furnaces; coke ovens; flue gas analytical systems.

Earth Physics Branch - Headquarters
1 Observatory Crescent, Ottawa, Ontario K2K 1Y8
Contact: Dr. P.A. Camfield, Program Officer, Tel: (613) 996-4463
Personnel: Total is 135.
Activities: The Earth Physics Branch collects, interprets and distributes geophysical information on the structure, processes and hazards of the solid earth. Crucial to the successful accomplishment of this task is the continual development of expertise in the fields of seismology, gravity, geomagnetism, geodynamics and geothermics as well as ancillary disciplines.

Geological Survey of Canada - Ottawa Division
601 Booth Street, Ottawa, Ontario K1A 0E8
Contact: M.A. Petre, Program Officer, Tel: (613) 995-4214
Personnel: Total is 496.
Activities: The Geological Survey of Canada is responsible for the conduct of geological, geophysical and geochemical research and surveys; estimation of mineral and non-renewable energy resources; investigation of geological phenomena affecting engineering works and the environment; development of geophysical and other technologies; development of national geoscience standards; fostering Canadian geoscience and international geoscience activities; cooperation with the provinces; provision of advice to government; and production and dissemination of maps and reports.
Facilities: Equipment for geochemistry, geochronology, sedimentology, analytical chemistry and mineralogy labs, machine shop, electronic shop; cartographic and photographic equipment, data processing equipment. Examples of individual items over $100K are: electron microprobes and minicomputer (for microprobe), scanning electron microscope, spectrometer, X-ray fluorescent spectrometer, mass spectrometers, Lanston monotype camera, plotting tables, 2 twin engine aircraft (Queenair and Skyvan), motor launch, precious metals.

Hydrocarbon Processing Research Laboratory
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: L. Janke, Deputy Manager, Tel: (613) 995-4473
Personnel: Total is 34.
Activities: The work of this laboratory is focused on the recovery or conversion of oil sands, natural gas, oil shales, coal and includes the foremost coal analysis group in Canada as well as expertise in the separation and characterization of conventional and synthetic crude distillates.
Facilities: Gasifiers; thermobalance reactor; distillation unit; fixed-bed hydrotreater; autoclaves; micro activity catalyst testing unit; surface spectroscopy; automated high pressure multi zone FT synthesis reaction equipment; gas and liquid chromatography; infra red spectroscopy; reverse osmosis and ultrafiltration bench scale equipment; plasma spectroscopy; atomic absorption; ion chromatography; coal analysers.

Mineral Sciences Laboratories
555 Booth Street, Ottawa, Ontario K1A 0G2
Contact: Mr. L.L. Sirois, Director, Tel: (613) 995-4119
Personnel: Total is 188.
Activities: The main thrust of the Mineral Science Laboratories' work is in mineral processing. The laboratories' main task is to research, develop and promaote technology to beneficiate ores, extract metals from concentrates and process marketable products, economically while preserving the environment. All aspects of processing are considered and include metallic and non-metallic minerals incorporating concrete and ceramic and for preparation of standards and reference materials. The main disciplines involved are minerology, mineral dressing, material processing, hydrometallurgy, pyrometallurgy, chemical assaying and supporting sciences.
Facilities: Spectrometers; Microbalances; Sluices; Magnetic Separator Sizers; Testing Machines; Freeze/Thaw Machines; Ovens; Grinders; Classifiers; Separators; Polishers; Cameras; Microscopes; Analyszers; Conductivity Apparatus; Diffusivity Apparatus; Calorimeters; Mixers; X-Ray Powder Diffractometer; Electron Microscope; Image Analyses System.

Physical Metallurgy Resource Laboratory (CANMET)
568 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Gilles Rochon, Office Manager, Tel: (613) 993-4930
Personnel: Total is 137.
Activities: The research conducted at the PMRL has two aims. The first is to provide technical support to government policy making and the second is to liaise with Canadian industry to develop new technology. PMRL is divided into two laboratories. Metals Development Laboratory conducts fundamental and practical research into the properties and structure of metals and alloys. The Metals Processing Laboratory conducts research on the making, shaping, joining and nondestructive evaluation of metals and alloys.

Polar Continental Shelf Project
880 Wellington Street, Ottawa, Ontario K1A 0E4
Contact: G.D. Hobson, Director, Tel: (613) 996-3388
Personnel: Total is 30.
Activities: Through arctic science and logistic support contributes to the orderly scientific investigation of Canada's polar continental shelf, the contiguous Arctic ocean and mainland regions.

Rock Mechanics Laboratory
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Mr. Glen E. Larocque, Manager, Tel: (613) 996-4570
Personnel: Total is 30.
Activities: The laboratory carries out mining technology research and technical investigations in the following areas: mining methods and equipment, mine evaluation, coal and uranium reserve assessment, mine cost models, rock mechanics and numerical models, rock structural properties and rock mechanics case studies.
Facilities: Computers/computer graphics/rock test equipment and facilities.

Surveys and Mapping Branch
615 Booth Street, Ottawa, Ontario K1A 0E9
Contact: Art Jansen, Branch Comptroller, Tel: (613) 995-4871
Personnel: Total is 906.
Activities: The Surveys and Mapping Branch is the federal government agency responsible for providing basic surveys and maps of Canada. The Branch's activities are of fundamental importance to the orderly and successful exploration and development of Canada's resources.
Facilities: Cartographic Data processing System, Doppler Satellite Receivers, Inertial Survey Systems, Deep Bench Mark Drill Rigs, Motorized Levelling Unit, Surveying Instruments.

Synthetic Fuels Research Laboratories
c/o 555 Booth Street, Ottawa, Ontario K1A 0G1
Contact: Jean M. Denis, Laboratory Manager, Tel: (613) 996-4570
Personnel: Total is 49.
Activities: There are two main sub-program activities in this laboratory, Petroleum Supply and Coal. Petroleum supply initiatives are mostly in the area of heavy oil and bitumen and coal initiatives are in co-processing and liquefication. The objective is to enhance the utilization of these resources.
Facilities: Distillation Unit; Spectroscopy; Analyzers; Calorimeters; Hydrocracking Pilot Plant; Coal Liquefaction Bench Unit; Autoclaves.

ENVIRONMENT CANADA

Canadian Wildlife Service - Ontario Region
1725 Woodward Drive, Ottawa, Ontario K1A 0E7
Contact: D.J. Hughes, Chief, Administrative Services, Tel: (613) 998-4693
Personnel: Total is 51.
Activities: To conserve and promote the conservation and enjoyment of Canadian wildlife and migratory birds. To provide opportunities for the development of awareness enjoyment, understanding and appreciation of Canadian wildlife heritage and its environment.

Environmental Protection Service: Hull
Place Vincent Massey, Hull, Québec K1A 0E7
Contact: R. Matteau, Chief, Financial Services Division, Tel: (613) 997-3733
Personnel: Total is 314.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.

Lands Directorate
20th Floor, Place Vincent Massey, Hull, Québec K1A 0E7
Contact: I. Crain, Acting Director, Land Resources and Data Systems Branch, Tel: (819) 997-2510
Personnel: Total is 45.
Activities: The aim of the Lands Directorate is to promote environmentally sound uses and management of Canada's land resources in keeping with federal responsibilities and national objectives. The Directorate's program has two major components: (1) Land Use Policy and Research, (2) Land Monitoring, Evaluation and Data Systems. The first component embraces land use policy development, socio-economic research on land use and methodological development for land use planning. The second covers the development of data bases on the characteristics and use of land, ecological research and land capability assessment, and data management and processing services. Associated with each component are related coordination, advisory and information services. It can be said that the Directorate is applying an interdisciplinary approach to develop an understanding and an appreciation of the country's land resources and their uses from a national perspective. And it is taking measures — frequently through cooperative action and other agencies — to promote full consideration of national land resource interests in the many planning and decision-making forums that influence the evolution of the land use pattern and the quality, productivity and management of the land.
Facilities: Main frame, mini and micro computer.

Migratory Birds Branch - Biometrics Section
Canadian Wildlife Service - 1725 Woodward Drive, Ottawa, Ontario K1A 0E7
Contact: S. Wendt, Chief, Tel: (819) 997-1121
Personnel: Total is 8.
Activities: Monitor distribution and abundance of waterfowl. To develop or improve surveys to determine production and populations of waterfowl species. To improve estimates and understanding of factors affecting mortality, and the relationship between hunting and non-hunting mortality. Design of experiments in wildlife research; develop estimators from mark recapture studies; store and retrieve biological information from bird banding and surveys.

Migratory Birds Branch - Waterfowl Research
Canadian Wildlife Service - 1725 Woodward Drive, Ottawa, Ontario K1A 0E7
Contact: Dr. G. Cooch, Senior Research Scientist, Tel: (819) 997-1841
Personnel: Total is 1.
Activities: Assessing the use of migratory birds by native people and the interaction of migratory birds with the natural environment and with man's activities.

National Hydrology Research Institute
351 St. Joseph Boulevard, Hull, Québec K1A 0E7
Contact: A.C. Lachance, Director, Tel: (819) 994-4010
Personnel: Total is 52.
Activities: Research into problems and phenomena of surface water, ground water and snow and ice. Ground Water Division studies the effects of (1) surface and subsurface disposal of radioactive wastes and other toxic wastes and (2) surface spills on the ground water regime. Transport phenomena in saturated and unsaturated porous and fractured media, particularly simultaneous flow of fluid and heat, and phenomena related to transport of material in solution. Parametric and physically based models of subsurface flow in the saturated and unsaturated zones. Fracture flow. Environmental assessment of the impacts of structures and excavations on the ground water regime. Permafrost and the ground water-permafrost relation in northern Canada. Surface Water Division investigates the interactions and exchanges between various phases of the hydrologic cycle. Flow systems and water balances in selected Canadian drainage basins. Effects of land drainage on stream hydrographs. River channel modification by fluvial processes. Parametric, stochastic and physically based models. Theory and rationale of modelling and investigation of limitations to modelling imposed by coarseness of model structure and imperfect knowledge of prototype. Regional evaporation. Water balance of arctic and subarctic basins. Freeze-up and break-up of rivers and lakes. River ice jamming. Hydrology of ground ice and aufeis. Examination of hydrologic aspects of northern development. Mountain hydrology. Snow and ice melt in hydrologic models. Remote sensing as a source of data for operational models. Techniques of interpreting remotely sensed data. Instrumentation for collection, recording and transmitting data. Microwave and infrared properties of wet and dry snow. Snowpack structure, its evolution during melting periods and its effects on runoff behaviour. Extraction and use of ice cores for developing paleoclimatic data.
Facilities: Glacier ice drill and corer.

National Wildlife Research Centre - Toxic Chemicals Program Section
100 Gamelin Boulevard, Hull, Québec K1A 0E7
Contact: Mr. W.K. Marshall, Section Head, Tel: (819) 997-1412
Personnel: Total is 7.
Activities: Study of the effects of pesticides used in agriculture and forestry on wildlife and its habitat. Management of the tissue bank of the collected specimens of Canadian wildlife for the future toxic residues measurements. Evaluation of the impacts of pesticides, industrial chemicals and other chemical hazards on wildlife and its habitat. Management of CWS toxic chemicals monitoring and research support services (specimen bank, tissue preparation labs, data base management, quality assurance, aviary, and chemical analyses by contracts) and the program coordination and development activities.
Facilities: For the specimen banks, 2 walkin freezers (20'x12'x10') are operated at -40C with "failsafe" backup (generators, spare compressors). Freezer design represents leading edge of conventional freezer technology for under $100,000 (1982) price range. There are a few comparable facilities in Canada.

National Wildlife Research Centre - Environmental Chemistry Section
100 Gamelin Boulevard, Hull, Québec K1A 0E7
Contact: Dr. R.J. Norstrom, Section Head, Tel: (819) 997-1410
Personnel: Total is 4.
Activities: Measurement of toxic chemicals residues in the tissues of wildlife, study of bioenergetic of Herring Gulls, organochlorine residues in polar bears and in marine mammals.
Facilities: GC/MS (Hewlett-Packard).

National Wildlife Research Centre - L.R.T.A.P. Section
100 Gamelin Boulevard, Hull, Québec K1A 0E7
Contact: K. Fisher, Coordinator, Tel: (819) 997-6086
Personnel: Total is 3.
Activities: Research on the effects of acid rain on Canadian wildlife and its habitat. Program Coordination for CWS - LRTAP. Scientific advice of LRTAP problem to DOE, interdepartmental and federal-provincial committees. Participation in scientific assessment of problem for Canada/U.S. negotiations on transboundary air pollution.

National Wildlife Research Centre - Bioelectronics Section
100 Gamelin Boulevard, Hull, Québec K1A 0E7
Contact: Not Available.
Personnel: Total is 1.
Activities: Development and use of biotelemetry methods for wildlife research and wildlife management.

National Wildlife Research Centre - Wildlife Toxicology Section
100 Gamelin Boulevard, Hull, Québec K1A 0E7
Contact: Dr. D.B. Peakall, Head, Tel: (819) 997-2780
Personnel: Total is 5.
Activities: Study of the effects of oil and oil dispersants on sea birds.

Parks Canada - Archeological Research Centre
10 Wellington Street, Hull, Québec K1A 3G2
Contact: Yvonne McNutt, Head, Administration, Tel: (613) 993-9800
Personnel: Total is 60.
Activities: Provide, through the research and analysis of physical, documentary and oral evidence, information necessary to determine significance, treatment and use of historic and pre-historic resources for Parks Canada's purposes and make it available for public benefit.

River Road Environmental Technology Centre
River Road, Ottawa, Ontario K1A 1C8
Contact: D.A. Williams, Chief, Tel: (613) 998-4130
Personnel: Total is 64.
Activities: Provides - Comprehensive air pollution measurement services including the development of new measurement technology - vehicle emissions measurement capability and advice on all aspects of automobile emissions control technology - the development and demonstration of environmental emergencies countermeasures technology - a full range of analytical laboratory services.
Facilities: Gas Chromatograph - Mass Spectrometer; Chasis Dynamometer

Water Planning and Management Branch
Ottawa, Ontario K1A 0E7
Contact: R.L. Pentland, Director, Tel: (613) 997-2071
Personnel: Total is 61.
Activities: Depending upon the nature of the work being conducted the Water Planning and Management Branch program activities can fall within any of the three stages - preplanning studies, planning studies or implementation activities. Research studies are undertaken at any one of these three stages. Topics may include water quantity, water quality, flood control, environmental impacts, socio-economic, water data, etc.

Water Resources Branch
Place Vincent Massey, 351 St. Joseph Boulevard, Hull, Québec K1A 0E7
Contact: D.R. Kimmett, Director, Tel: (819) 997-1508
Personnel: Total is 39.
Activities: The collection, processing, analysis, storage, interpretation, and provision of water quantity and sediment data for water resources management.
Facilities: Data Collection Platforms (DCP); Power Supply Systems; Sensors; Portable Data Logger.

FISHERIES AND OCEANS

Atlantic Fisheries Development Branch
200 Kent Street, 11th Floor, Ottawa, Ontario K1A 0E6

Contact: Mr. Bruce Deacon, Director, Fisheries Development, Tel: (613) 990-0125
Personnel: Total is 26.
Activities: Atlantic Fisheries Technology activities are coordinated from Ottawa HQ and implemented from four regional offices located in St. John's (Newfoundland Region), Halifax (Scotia-Fundy Region), Moncton (Gulf Region), and Québec City (Québec Region). All work is carried out through contracts and joint arrangements. The main thrust of the program includes applied industrial research and development of fisheries technology directed at the Atlantic commercial fishing industry. The four main objectives include: expansion of the commercial resource base; reduction in the cost of harvesting, processing, handling, and storage; increased value added to the resources; more conservation-oriented harvesting of the resource.

Canadian Hydrographic Service
615 Booth Street, Ottawa, Ontario K1A 0E6
Contact: J. O'Shea, Chief, Planning, Tel: (613) 995-4358
Personnel: Total is 130.
Activities: Not available

Fisheries Research Branch - Ontario Region
867 Lakeshore Road, P.O. Box 5060, Burlington, Ontario K7R 4A6
Contact: Mr. J. Cooley, Research Director, Tel: (416) 637-4568
Personnel: Total is 44.
Activities: The Great Lakes Fisheries Research Branch is located in the western end of Lake Ontario at the Canada Centre for Inland Waters in Burlington. There are also two regional labs at Owen Sound, on Georgian Bay, and at Sault Ste. Marie, on Lake Superior. Limnological and fisheries research and surveillance tests the effects of the eutrophication and contaminants on Great Lakes water quality, biota, community structure and productivity. Similar studies on smaller Ontario lakes determine the impacts of acid precipitation as part of national program of monitoring and research. Laboratory research in aquatic toxicology and contaminants dynamics is conducted to develop water quality objectives and more rapid methods for hazard evaluation and toxicity assessment in the field. An ultra-trace chemicals laboratory located at CCIW, serves the needs of fish research as well as fish quality inspection. Other studies include: (1) fish habitat rehabilitation; (2) the effects of contaminants on conversion efficiency in natural food chains; and (3) the application of quantitative structure-activity relationships to hazard assessments of contaminants.

Marine Environmental Data Services Branch
200 Kent Street, 12th Floor, Ottawa, Ontario K1A 0E6
Contact: Dr. J.R. Wilson, Director, Tel: (613) 990-0264
Personnel: Total is 42.
Activities: To acquire, process and archive tide and water level data, measured wave data, and physical-chemical oceanographic data; to provide data processing and expertise to the international oceanographic community; to provide data, data products and ocean information on request; to develop improved methods and techniques in data processing and archiving, new data products.
Facilities: Mini-computers and peripherals, plotter, digitizers, micro-computers, computer terminals, microfilm devices, waverider buoys and related equipment.

HEALTH AND WELFARE CANADA

Drugs Directorate
Brooke Claxton Building, Boulevard de la Colombine, Ottawa, Ontario K1A 0L2
Contact: Debbie Hills, Chief Administrative Officer, Tel: (613) 990-8857
Personnel: Total is 443.
Activities: The Drugs Directorate consists of seven bureaux: Biologics, Dangerous Drugs, Drug Research, Drug Quality, Human Prescription Drugs, Nonprescription Drugs, and Veterinary Drugs. The directorate is responsible for ensuring the safety and efficacy of human and veterinary drugs which are manufactured or offered for sale in Canada, as well as for the safety of cosmetics. New drug submissions and applications for proprietary medicines are evaluated nationally for their safety and efficacy, and also with respect to manufacturing and labelling aspects. The directorate also licenses vaccines and other biological drugs for manufacture and sale. Surveillance programs are carried out to assess the safety, efficacy, pharmaceutial quality, advertising and manner of use of marketed drugs. It also carries out programs to control the misuse and abuse of drugs, particularly psychoactive ones, and to provide information to health professionals and to the general public on the quality and the wise use of drugs. The Drugs Directorate maintains the Bureau of Drug Research which carries out investigations in fields of toxicology (eg. carcinogenicity, mutagenicity, allergenicity) and of pharmaceutical chemistry and develops analytical methods in these fields. This laboratory expertise enables the directorate to make informed decisions on drug safety, efficacy, and quality. The Bureau of Drug Research consists of three divisions: Drug Identification, Drug Toxicology, and Pharmaceutical Chemistry. One of the main functions of the Bureau relates to drug standards and the development of assay methods for synthetic drugs, for drugs of natural origin, and for impurities in drugs.

Environmental Contaminant Directorate
Jeanne Mance Building, Tunney's Pasture, Ottawa, Ontario K1A 0L3
Contact: Mr. C.E. Tupper, Director, Environmental Health Services, Tel: (613) 990-7734
Personnel: Total is 4.
Activities: Protection of health of clients (Indian and Inuit, Public Servants, travellers and all Northern Residents) from those factors in the physical environment which may be hazardous.

Environmental Health Directorate
Brooke Claxton Building, Boulevard de la Colombine, Ottawa, Ontario K1A 0L2
Contact: Not Available.
Personnel: Total is 257.
Activities: The Environmental Health Directorate serves to protect Canadians from health hazards associated with natural and man-made environments, the components of which are the physical, chemical and technological encompassments in which modern man lives and works. Its main program areas are directed towards: the assessment and investigation of the health effects of environmental pollutants and health hazards associated with, and the control of, medical devices, radiation sources and hazardous products; in conjuction with the other organizational units of the Department, the assessment of the health effects of the Department, the assessment of the health effects of technological and sociological environments.

Environmental Health Lab
Pharmaceutical Chemistry Building, Tunney's Pasture, Ottawa, Ontario K1A 0L3
Contact: Dr. J. Kirkbride, Director, Occupational Health Unit, Tel: (613) 990-8393
Personnel: Total is 27.
Activities: Analytical and advisory services relating to environmental aspects of Indian and Inuit population, as well as to the health and safety of Federal Public Service.
Facilities: Air Flow Equipment; Chemical Analysis Equipment.

Food Directorate
Brooke Claxton Building, Boulevard de la Colombine, Ottawa, Ontario K1A 0L2
Contact: T. Theriault, Administration Officer, Tel: (613) 990-8983
Personnel: Total is 253.
Activities: In the Food Directorate, scientific activities protect the public against deficiencies in the nutritional quality of foods and from microbial and chemical hazards that might cause illness. Major organizational units are the Bureaux of Chemical Safety, Microbial Hazards and Nutritional Sciences. The Food Directorate works together with the Field Operations Directorate in administering the food provisions of the Food and Drugs Act. Research divisions carry out studies in such fields as: microbial hazards in food; the toxicology and food chemistry of food additives, contaminants and components; the nutrient composition of food, nutritional status and bioavailabililty and effects of nutrients; and the development of analytical methods for use in monitoring and surveillance. Scientific evaluation divisions exert influence on food safety through contributions to the development of policies, guidelines and regulations that take account of data from research and regional laboratories and from detailed review of industry submissions (eg. regarding the use of food additives and agricultural chemicals). The risks and benefits of chemical use and of other changes in foods and eating habits are issues for which a scientific basis for decision is provided.

Laboratory Centre for Disease Control
Brooke Claxton Building, Boulevard de la Colombine, Ottawa, Ontario K1A 0L2
Contact: J.S. Baylis, Chief, Administrative Services, Tel: (613) 990-8972
Personnel: Total is 206.
Activities: The Laboratory Centre for Disease Control is mainly a service-oriented directorate, whose primary function is to provide epidemiological information, microbiological data, and diagnostic reagents to provincial governments, hospitals and laboratories. The directorate provides a national focal point and liaison in epidemiology and microbiology to international organizations, including the World Health Organization, Centre for Disease Control in the United States, and the Public Health Laboratory Services in England. The Centre for Disease Control has 5 scientific bureaux: Epidemiology, Infection Control, Medical Biochemistry, Microbiology, and Tobacco Control and Biometrics. The two disease surveillance bureaux, Epidemiology and Infection Control, monitor the incidence and causes of disease in Canada. They provide epidemiological assistance in epidemic situations and coordinate strategies for the control and prevention of communicable and non-communicable diseases. They also provide a surveillance system to study factors as potential causative agents in congenital anomalies, adverse reaction to drug products, and acute poisoning. In the field of infection control, special programs are designed to assist in reducing the high toll of hospital and laboratory-acquired infections. The Medical Biochemistry and Microbiology Bureaux provide services to asssist provincial and clinical laboratories in the diagnosis and treatment of disease. The Tobacco Control and Biometrics Bureau develops alternative federal regulatory policies concerning the manufacture, importation, distribution, sales and use of tobacco products and psychotropic drugs, together with the provision of advice on statistical design and analysis of directorate projects, experimental surveys.

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

60 Queen Street, Ottawa, Ontario K1G 3H9
Contact: Not Available.
Personnel: Total is 103.

Activities: To initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means of applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions. DEVELOPMENT RESEARCH: Support for research in agriculture, food and nutrition, in health, in social sciences, in information research, as well as support for a program aimed at the development of human resources. RESEARCH RELATED ACTIVITIES: Activities designed to identify and develop research projects, to disseminate research findings and support the research library of the Centre. COOPERATIVE PROGRAMS: Support for joint research activities between Canadian and Third World institutions in areas where Canada has research and development expertise.

MEDICAL RESEARCH COUNCIL OF CANADA

20th Floor, Jeanne Mance Building, Tunney's Pasture, Ottawa, Ontario K1A 0W9
Contact: Mr. Guy D'Aloisio, Chief, Financial Services, Tel: (613) 593-7865
Personnel: Total is 54.
Activities: The Council's objective is to promote and assist basic, applied, and clinical research in the health sciences and to support the training and development of research manpower, with the intention of helping to attain the quality and scale of research essential to the maintenance and improvement of health services. Having no laboratories of its own, the Council seeks to fulfill its mandate through the support of health science research and research training carried out primarily in faculties of medicine, dentistry, pharmacy, nursing, and veterinary medicine and their affiliated hospitals and institutes across Canada. Through its grants-in-aid program, funds for the direct costs of research are provided for research projects, the purchase of major equipment, and the operation and maintenance of shared facilities. Special programs have been designed for the support of collaborative and interdisciplinary research, for the stimulation of research in particular fields or in the application of biotechnology, and for the development of a more adequate research base in designated faculties. Through its manpower support programs, salary support is provided for a limited number of outstanding independent academic investigators, and for a limited number of highly qualified candidates undertaking full-time research training at the undergraduate level (summer students), at the predoctoral level (graduate students), or after having obtained an M.D., D.D.S., D.V.M., Pharm.D., or Ph.D. degree (postdoctoral fellows). Other programs afford opportunities for collaboration and exchange of information between Canadian scientists and their colleagues in Canada and abroad, and support the costs of workshops and symposia designed to address specific questions of importance to research in the health sciences in Canada and to reach a consensus on recommendations or conclusions.

NATIONAL CAPITAL COMMISSION

161 Laurier Avenue West, Ottawa, Ontario K1P 6J6
Contact: J. Smrcka, Supervisor, Operating Budget Control, Tel: (613) 993-4142
Personnel: Total is 1007.
Activities: The National Capital Commission conducts or promotes research, plans and studies related to the development of the National Capital Region as a symbol of identity for all Canadians. The areas of programs in which this Commission are involved include land development, transportation, provision of services and utilities, the encouragement and assistance in activities of a recreational or cultural character, and the development and management of parks and parkways.

NATIONAL DEFENCE

Defence Research Establishment: Ottawa
Ottawa, Ontario K1A 0K2
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 206.
Activities: DREO, located at Shirley's Bay, West of Ottawa, carries out applied research in a variety of areas including environmental protection, clothing, defensive aspects of nuclear, biological, and chemical warfare, electrical power sources, remote sensing, navigation, electronic warfare, satellite aided search and rescue, and some other aspects of space applications. DREO is also responsible for the military communications and radar research programs at the neighboring Communications Research Centre (CRC) of the Department of Communications.
Facilities: Mobile Lab - Radiation Measurement.

Operational Research and Analysis Establishment
101 Colonel By Drive, Ottawa, Ontario K1A 0K2
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 141.
Activities: The function of the ORAE in NDHQ is largely oriented toward system analysis, logistic, strategic, social and economic analysis relative to the Canadian Forces.

NATIONAL MUSEUMS OF CANADA

National Museums of Canada - Headquarters
300 Laurier Avenue West, Ottawa, Ontario K1A 0M8
Contact: Mike Morissette, Financial Planning Analyst, Tel: (613) 996-9374
Personnel: Total is 366.
Activities: National Museum of Natural Sciences - The National Museum of international stature that collects records, preserves, seeks to understand and communicates collections of objects and related knowledge in the natural and physical sciences (including botany, zoology, paleontology, earth sciences and astronomy).

Botany Unit
300 Laurier Avenue West, Ottawa, Ontario K1A 0M8
Contact: Mike Morissette, Financial Planning Analyst, Tel: (613) 996-9374
Personnel: Data not available.
Activities: Taxonomy, ecology and geographic distribution of vascular plants, bryophytes, lichens and algae. Monographic studies of genera. Regional floristics.

Zoology Unit
300 Laurier Avenue West, Ottawa, Ontario K1A 0M8
Contact: Mike Morissette, Financial Planning Analyst, Tel: (613) 996-9374
Personnel: Data not available.
Activities: Taxonomy, distribution, ecology, and behavior of mammals, birds, reptiles, amphibians, fishes, and all invertebrate groups, exclusive of insects, arachnids, nematodes, and certain parasitic groups that are the concern of other federal governmental agencies.

Paleobiology Unit
300 Laurier Avenue West, Ottawa, Ontario K1A 0M8
Contact: Mike Morissette, Financial Planning Analyst, Tel: (613) 996-9374
Personnel: Data not available.
Activities: Taxonomy and dispersal history of fossil vertebrates from Canadian Palaeozoic, Mesozoic, Tertiary, and Pleistocene deposits, with emphasis on dinosaurs and Pleistocene vertebrates. Palynological research involving light microscopy, pollen morphological studies on selected angiosperm families. Evolution of the fungi and symbiosis in general.

Mineral Sciences Unit
300 Laurier Avenue West, Ottawa, Ontario K1A 0M8
Contact: Mike Morissette, Financial Planning Analyst, Tel: (613) 996-9374
Personnel: Data not available.
Activities: Systematics, taxonomy and genesis of minerals and rocks, with emphasis on those from important Canadian geological occurences.

NATIONAL RESEARCH COUNCIL CANADA

Advanced Teleoperator System
Ottawa, Ontario K1X 1X1
Contact: Not Available.
Personnel: Data not available.
Activities: Not available

Algonquin Radio Observatory
Lake Traverse, Ontario K0A 2L0
Contact: Not Available.
Personnel: Total is 22.
Activities: Continuum and spectral line studies using the 46 cm radio telescope at the Algonquin Radio Observatory; time variations of Seyfert galaxies and quasars, and study of their structure and size by long baseline interferometry; intensity of 10 cm radiation from the sun and high resolution observations with 10 cm array. Optical studies of the solar photosphere and chromosphere.

Canada Centre for Space Science: Ottawa
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 40.
Activities: This Centre's program includes: mission analysis and systems engineering for space science instrumentation; design and development of space science instrumentation for space shuttle and satellite flight systems including charged particle detection, optical detection and imaging, ultraviolet imaging, radar imaging and radio frequency plasma waves; design and development of rocket payloads, rocket vehicle systems, telemetry tracking and data processing systems for space science use; operation and maintenance of facilities for launching and recovering of scientific rockets and balloons.

Canada Institute for Scientific and Technical Information
Montreal Road, Ottawa, Ontario K1A 0S2
Contact: Michel Bergevin, Chief, Administrative Services, Tel: (613) 993-1075
Personnel: Total is 245.
Activities: The institute maintains the national collection of scientific, technical and medical literature and provides scientific, technical and medical information to the people and government of Canada to assist in activities related to the economic, regional and social development of Canada. Major activities include the administration of CAN/OLE, the Canadian online enquiry system, CAN/SDI, the Canadian service for the selective dissemination of information, CAN/SND, scientific numeric databases, the largest lending and photocopying service in Canada and a reference, referral and literature searching service.

Computation Centre
Ottawa, Ontario K1X 1X1
Contact: Not Available.
Personnel: Total is 76.
Activities: Not available

Division of Biological Sciences
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 302.
Activities: As listed below.

Biotechnology Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: The use of living organisms, plant or animal cells and their parts - to produce commercial goods and services - is centered at three locations in Canada: NRC's Division of Biological Sciences in Ottawa, the Plant Biotechnology Institute in Saskatoon, and the Biotechnology Research Institute being established in Montréal. Altogether these establishments will house almost 600 scientists, engineers, and technology staff and will extend the coordinated national program of research and development into living systems and their materials.

Cell Physiology Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Control systems in cell proliferation; the earliest steps in DNA synthesis in normal and cancer cells; the role of calcium ion and cyclic AMP as controls.

Animal Physiology Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Environmental effects on physiological systems: mechanisms of acclimation to cold; structure and function of noradrenergic vesicles in sympathetic endings of brown adipose tissue; blood flow regulation in brown adipose tissue; bioelectric phenomena.

Ecotoxicology Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Behavior and toxicology of environmental contaminents, particularly heavy metals; mechanisms of toxicity at molecular level.

Biomathematics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Statistics, computations, design of experiments, computer modelling and simulation techniques.

Microbiology and Immunochemistry Units
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Anaerobic microbiology, methanogenic bacteria, hydrogenases, continuous culture studies, enteratoxins, growth of pathogenic bacteria. Antigens of pathogenic bacteria, neisseria species, chlamydia, penumococcus, streptococcus; structure-function in polysaccharide antigens, use in vaccines and diagnostics; synthetic antigens; monoclonal antibody from hybridomas; immunoglobulins.

Biological Production of Fuels Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Biogas fermentation; practical production of biogas from sewage sludge and food wastes; preservation of fruits and vegetables by high-humidity refrigerated storage.

Molecular Genetics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Cloning of genes in yeast and bacteria; transformation of yeast; studies on gene expressions; synthesis of genes and of linker segments for plasmid linking; structure of chromatin; restriction enzymes; ribasomes structure.

Molecular Biophysics and Biochemistry Units
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Use of nuclear magnetic resonance and electron spin resonance to study structure-function relations in biological systems; the dynamics of biological membranes; definition of receptor sites.

Cell Biophysics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Biosynthesis of cellulose; fibrogensis in cells; electron microscopy.

X-Ray Crystallography Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Crystal structures of compounds of biological interest, nucleotides, pharmaceuticals; correlation of structure with biological activity.

Molecular Biochemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Protein biochemistry; isolation and characterization of enzymes, hydrogenases, protein kinases, sulfatases; studies of enzyme-substrate reactions by laser Roman spectroscopy and fluorescence spectroscopy.

Division of Chemistry
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 283.
Activities: As listed below.

Analytical Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including trace analysis of marine waters, sediments and biological materials; inductively coupled plasma - optical emission spectroscopy; atomic absorption spectroscopy (GFAAS and FASS); spark source mass spectroscopy; trace metal separations and concentrations; gas chromatography - mass spectrometry; x-ray fluorescence spectroscopy.

Chemical Engineering Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including reverse osmosis, ultrafiltration, sludge and emulsion treatment, fluid-particle technology, size enlargement, fine coal beneficiation methods. Cooperation with industry in both laboratory and plant environment.

Chemical Physics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including electrical and optical properties of thin film semiconductors; electron spin resonance; spectroscopy and kinetics of transient species on the nanosecond time scale.

Colloid and Clathrate Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including extraction of bitumen oil sands by spherical agglomeration; emulsions and suspensions; chemistry of heavy oils; molecular orbital and intermolecular potential theory; study of clathrate hydrates and other solids by NMR, dielectric, and calorimetric methods. Applies the concepts of colloid science to the solution of problems of industrial concern.

High Polymer Studies Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including ionic polymerization mechanisms with special reference to sterioregulation processes.

High Pressure Studies Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including physical chemistry at high pressures (kinetics of reactions in solutions, infrared and Raman spectra, phase transformations, structure, x-ray diffraction, inorganic chemistry, etc.)

Hydrocarbon Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Investigates the rates and mechanisms of free-radical reactions in solution; studies the structures and reactivities of carbenes and free-radicals; synthesizes new antioxidants and tests their effectiveness in vitro; conducts studies on normal and isotopically labelled vitamin E and investigates the biological role of the vitamin in normal and cancerous tissue.

Kinetics and Catalysis Studies Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including chemical reactions of atmospheric interest; chemisorption and heterogeneous catalysis; electron spin resonance spectra and structure of organo-metallic and inorganic free radicals.

Photochemistry and Kinetics Studies Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Fundamental processes in the photochemistry of gases, including visible ultra-violet systems and infrared multiphoton reactions using pulsed lasers; investigates kinetics of the reactions of atoms, free radicals in gas-phase thermal, photochemical and radiation chemistry systems; explores the microscopic dynamics of elementary reactions of atoms, free radicals and molecules in the gas phase using infrared chemiluminescence and molecular-beam techniques; examines reactions of transient species in liquid-phase photochemical systems in the nanosecond and picosecond time regime.

Laser Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including laser induced chemical processes: isotope separation; multiphoton effects; photo-selective organic synthesis; remote sensing; transient detection, kinetics and dynamics using laser induced fluorescence, multiphoton ionization and time-of-flight mass spectrometry; inorganic photochemistry emphasizing metal atom reactions. Promotes the use of laser technology in industrial applications.

Metallic Corrosion and Oxidation Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including mechanisms and kinetics of metal oxidation; electrochemistry; surface film characterization. Provides advice on corrosion related problems.

Molecular Spectroscopy Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including infrared and Raman spectroscopy; vibrational spectra of complex molecules of biological importance, including membranes; vapor phase Raman intensities and band contours; development of new vibrational Fourier transform techniques. Investigates the structure of aqueous surfactants; maintains computer-based programs for the automatic indentification of materials from their infrared spectra.

Organic Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including partial and total synthesis of biologically interesting molecules (steroids, alkaloids, antibiotics, anticancer agents); transformation of natural products; scope and mechanism of new reactions; electro-organic synthesis. Administers the Federal Energy Conversion and Hydrogen Storage Program.

Solid State Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including chemistry and physics of metals, alloys and compounds; solid state inorganic chemistry; x-ray diffraction and crystallographic computation.

Textile Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including photochemistry of fibre-forming polymers; UV stabilization; morphology of polymers and composites; x-ray diffraction; flammability, flame retardants; thermal analysis. Evaluates technical methods for fibres and fabrics including the international methods and develops test methods and standards suitable for Canadian needs.

Theoretical Chemistry Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Studies equilibrium and dynamical properties of solids and liquids; the dynamics of laser-excited resonance fluorescence in atoms and molecules by analytical methods; the generation and decay of excited and ionized states in molecules and molecular crystals by quantum-mechanical methods with special emphasis on organic systems; static and dynamic properties of biomolecules and bi-polymers including protein folding and enzyme action through computer simulation.

Thermochemistry Studies Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Thermodynamic properties of liquids and binary mixtures; uses calorimetric techniques to determine the heat capacities and excess enthalpies of binary liquid mixtures; investigates the volumetric properties of liquids through density, dilatometric and ultrasonic measurements; and correlates thermodynamic data by means of empirical and theoretical relations.

Division of Electrical Engineering
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 275.
Activities: As listed below.

Computer Technology Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including development of advanced hardware/software technology in the areas of computer graphics, image processing, signal processing, industrial sensors, information storage and retrieval, data base techniques and interactive man-computer systems. Emphasis on technology, new innovative products and processes and other such areas contributing to economic development and industrial productivity.

Electromagnetic Engineering Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Develops mathematical techniques for the solution of fundamental problems in electromagnetic and antenna theory and problems of interest to other sections; develops measurement and maintains facilities for the design and evaluation of antennas and for the analysis of electromagnetic interference; by membership on Canadian Standards Associations Committees assists in the production of standards dealing with electromagnetic interference; applies radar principles to study the polarization effects of precipitation; promotes the direct conversion of microwave energy to heat for industrial applications, and develops moisture and electromagnetic radiation sensors.

Electronics Engineering Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Develops instrumentation and software for intelligent robotic sub-systems in the following areas: optical-electronic measurement and inspection systems; three-dimensional vision systems; optical filtering techniques; microprocessor systems; interface between measurement and control systems. Develops direct solar energy conversion in the following areas: development of photovoltaic power systems/devices; development of electronic power conversion and control equipment for photovoltaic applications; evaluation of the performance of photovoltaic modules. Also maintains and repairs the division's electronic instruments.

Medical Engineering Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including exploratory and applied research into the interaction of non-ionizing radiation and low frequency current flows on the biological system, including ultrasound and 60Hz. Analyzing biological signals and processes as they apply to the clinical situation, for the disabled and its application in improving and increasing indepedence, vocational opportunities and quality of life. Design and development of guidance systems for the blind, communication devices for the severely handicapped, postural and locomotion aids.

Power Engineering Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including research and development of current comparator and other techniques in the precise measurement of voltage, current, impedance, power and energy at direct and low frequency alternating currents. Measurement of corona phenomena on high voltage direct current transmission lines under various weather conditions for the prediction of corona losses, radio noise and audible noise from proposed long lines. Study of the mechanisms of aging of polymeric insulating materials for use in underground distribution cables. Study of the methods of measuring high voltage impulses and the requirements of impluse measuring systems to meet the required standards. Develops precision instrumentation for the electrical power industry and standards laboratories.

Electron Physics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Investigates the measurement, creation, processes, and application of ultra-high vacuum technology; studies surfaces with regard to their order, chemical and physical properties, utilizing beams of electrons, ions, molecules and photons; investigates quantum electronics and the physical processes controlling the operation of lasers; maintains and operates a liquid helium facility supplying liquid helium to internal and external users.

Information Science Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Maintains and operates a computer network for comparative research in computer-aided design and manufacture and computer-aided training; develops terminals and software for specialized interactive computer applications; develops and operates a national authorizing language (NATAL) and supporting software for computer-aided learning; pursues information storage and retrieval activities with a focus on data base systems for CAD/CAM applications; studies computer-aided design with a focus on development of computer-based models to assist in the design/decision process; develops electronic data processing standards through measurement on government and Canadian Standards Association committees.

Division of Energy
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 74.
Activities: As listed below.

Hydrogen and Energy Storage Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages a national program related to the storage of energy, including the use of hydrogen as an energy carrier; in collaboration with industrial and other contractors, develops advanced systems for hydrogen production by electrolytic and other processes; studies appropriate systems for the transmission and storage of hydrogen, as hydrites and other high-pressure fluids; develops and evaluates systems for hydrogen utilization, including electrochemical systems (fuel cells) and mechanical systems (heat engines); develops and evaluates other energy storage systems, including electrochemical storage batteries and high-energy flywheels.

Solar Energy Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages a national program of research and development on the use of solar energy, including passive and photovoltaic as well as active thermal systems; guides and supports the generation of basic research and data collection related to utilization of solar energy in Canada; in collaboration with Canadian industry, develops components, products and systems for the economical harnessing of solar energy, and assists in the establishment of an indigenous solar energy industry; analyses, correlates and disseminates information on solar energy to government, industrial and user communities, informs appropriate users to their needs; contributes technically to the establishment of standards in the manufacture, installation and maintenance of solar equipment.

Peat Energy Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages a national peat research and development program, related to peat as energy stock; conducts in-house research to develop novel uses for peat; in cooperation with international agencies, develops standards for peat classification, terminology and test; contracts peat research through requests for proposals (RFPs) and unsolicited proposals (UPs); maintains the secretariat and related functions of the Canadian National Committee of the International Peat Society.

Heat Pump Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages the federal program on research and development on heat pumps, to exploit their energy conservation capabilities; evaluates the industrial applications of heat pumps for energy recovery energy cascading, drying, heating; develops and evaluates residential heat pump systems for space heating and cooling for domestic water heating, both stand-alone or with auxillary sources; in collaboration with Canadian industry, develops systems components and equipment, including control systems, refrigerants, valves, condensers, evaporators, motor drive systems.

Wind Energy Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages federal government research and development in wind energy; compiles and interprets meteorlogical data to identify regional wind energy resources availability and other climatological factors affecting wind turbine performance and longevity; develops analytical and experimental methods for assessing of local topography and wind regimes at candidate turbine sites; assesses circumstances under which wind energy makes cost effective contributions to Canadian energy supplies; investigates fundamental aerodynamic and structural dynamic behavior of vertical-axis wind turbines; conducts

laboratory and field trial experiments to verify performance and structural design techniques in collaboration with Canadian manufacturers and potential user agencies; establishes Canadian standards for safety, performance etc., for small wind energy conversion systems via the Canadian Standards Association.

Fusion Energy Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages a national program of research and development, towards a long-term inexhaustible energy option; in collaboration with Hydro-Quebec, operates the Canadian Centre for Magnetic Fusion, which has under construction a major national facility, the Tokamak de Varennes; in collaboration with Ontario Hydro and the Ontario Government, operates the Canadian Fuels Technology Project, which is a contracted-out program of research designed to establish Canada as a world leader in the technologies for management of tritium as a fusion fuel; coordinates a national program of research in inertial confinement fusion, focussed on high-power lasers and their interactions with plasmas; coordinates a program of international collaboration with the fusion programs of the USA, Japan, and the European Community.

Bioenergy Program
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Coordinates and manages a national program of research and development in bioenergy; supports research into the fundamental problems associated with the conversion of wood (cellulose, hemicellulose, lignin) into enhanced forms of energy; develops improved technologies to allow complete mechanization of energy plantation systems including site preparation, planting, cultivation, harvesting, collection, pre-treatment and transportation; studies the extent and nature of the biomass to an appropriate form; provides technical advice to the federal government relative to national bioenergy policies and programs.

Division of Mechanical Engineering
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 347.
Activities: As listed below.

Engine Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Studies are formed on energy use in road vehicles including aerodynamics, traffic control strategies for urban areas, and diesel to natural gas fuel conversion, and in machinery for energy conversion including gas turbines and other industrial rotating machinery.
Facilities: Gas turbine engine; test cells; anechoic test cell; rotor dynamics facility.

Gas Dynamics Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Studies are performed on: flow of fluids at large flow rates including combustion, turbine and compressor aerodynamics and heat transfer; dynamics of fluids at high pressures such as high pressure water jets for industrial cutting purposes and plasma dynamics including basic experimental, theoretical and numerical studies of hot gases produced by magnetically-driven shock waves.
Facilities: Small aviation gas turbines; altitude test facilities; compressor test facility; industrial gas turbine compressor test facility; large flow rate compressor and exhaustic plants; wind tunnel for propulsion studies.

Hydraulics Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Work is performed on coastal engineering including physical processes of oceans and rivers, ice and wave mechanisms and simulation of sea states and on hydraulic energy such as the potential contained in oceans, rivers, currents and tides.
Facilities: Flumes; wave machines; and hydraulic test basins.

Low Temperature Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Research is conducted on energy conversion and conservation at low temperatures including heat pumps, solar energy and refrigeration equipment in northern environmental conditions; and on climatic effects on industrial equipment including icing effects.

Manufacturing Technology Centre
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Research focusses on the application of computer technology including robotics to industrial manufacturing processes including flexible manufacturing systems which integrates a five-axis machining centre.

Railway Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Investigations are conducted on road and rail advanced vehicle concepts. The laboratory maintains and operates national facilities for rail vehicle research, testing and certification including a curved trench simulator, a vibration test stand, a squeeze frame and a high altitude test chamber.

Systems Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Research is conducted on industrial automation and ergonomics including man/machine interfaces and sensor development and on computer modelling and simulation.

Fuels and Lubricant Laboratory
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Research is performed on properties and application of engine fuels with emphasis on the road and rail mode and on test methods for petroleum products.

Division of Microstructural Sciences
Montreal Road, Ottawa, Ontario K1A 0R5
Contact: Not Available.
Personnel: Total is 36.
Activities: The Division of Microstructural Sciences has been established because of the long-term importance of microelectronics and parallel technologies such as microphotonics and micromechanics. The division will be made up of existing personnel from the Physics and Electrical Engineering divisions of NRC.

Division of Physics
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 283.
Activities: The Division's research program includes - acoustics including outdoor noise propagation, external ear and acoustical standards - electrical and time standards - heat and thermometry including oceanographic and meteorological measurements - high energy physics including studies on interaction of nuclei in emulsions - laser and plasma physics including high power laser development, laser diagnostics and laser/plasma interactions - mechanical and optical physics including primary and secondary mass, length standards, laser frequency stabilization and measurement and optical coatings and filters - optics including: basic standards in radiometry, photometry and calorimetry; research on colour vision; performance and properties of optical and photographic materials; and measurement of solar radiation - photogrammetric research including new concepts and technology for photogrammetric instrumentation; development of methods and software for off-line and on-line analytical photogrammetry; research into factors limiting photogrammetric accuracy; research in digital image processing in photogrammetry; investigations into atmospheric refraction in photogrammetry and geodesy - solid state science including calorimetry and electronic structure of metals and alloys - X-rays and nuclear radiation including X-ray and Y-ray exposure standards, absorbed dosecalorimety, radiation transport and chemical dosimetry.

Herzberg Institue of Astrophysics
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 171.
Activities: As listed below.

Astronomy Unit
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including continuum and special line studies using 46m radio telescope at the Algonquin Radio Observatory; time variations of Seyfert galaxies and quasars, and study of their structure and size by long baseline interferometry; intensity of 10cm radiation from the sun and high resolution observations with 10cm array. Optical studies of the solar photosphere and chromosphere.

Planetary Sciences Unit
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including studies of the ionosphere and auroral plasma by radio wave scattering techniques and rocket-borne probes; auroral spectroscopy and photometry; operates the Meteorite Observation and Recovery Project, a network of semi-automatic camera stations in the prairie provinces for determining the trajectories of bright meteors.

Spectroscopy Unit
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including high resolution studies of spectra of molecules, free radicals and ions in microwave, infrared, visible, ultraviolet and vacuum ultraviolet regions. Interpretations for spectra of astrophysical interest, studies the effects of electric and magnetic fields on molecular spectra, develops spectrascopic techniques.

Space Physics Unit
Sussex Drive, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including studies of plasmas and fields in earth's magnetosphere and high latitude ionosphere using rockets and satellites. Studies of solar and galactic cosmic rays using ground-based and spacecraft instrumentation. Operates a network of cosmic ray monitors with stations at Ottawa, Deep River, Goose Bay, Inuvik, and Alberta.

Industry Development Office: Ottawa
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 89.
Activities: This Office is responsible for managing NRC's industrial assistance programs: Program for Industry/Laboratory Projects (PILP) and the Industrial Research Assistance Program (IRAP). It also performs industrial policy reviews and analyses to aid the office and NRC as a whole on industrial policy issues. The PILP program offers Canadian industry the scientific know-how of research laboratories at the National Research Council and other science-based government departments. Technical assistance by government experts involves consultation, delivery of research data, training of company personnel, collaborative research or access to government laboratory facilities. One of the prerequisites for PILP support is that the Canadian company has sufficient technical and business capability to commercialize the results of suitable projects. The government's financial assistance is determined on a negotiated cost-sharing basis. PILP will also contribute towards the cost of visiting various laboratories when the companies are located at some distance from the laboratories. The IRAP program encourages firms to undertake R&D leading to furthering the economic development of Canada. Through IRAP, the scientific and R&D management resources of federal government and other laboratories are brought to the support of industry. IRAP projects and activities assist firms of all sizes to tackle their technical problems and challenges. The IRAP program consists of six elements: IRAP-C: Field Advisory Service; IRAP-F: Technical Information Service; IRAP-H: Contributions to Firms Employing Undergraduates; IRAP-L: Contributions to Laboratory Investigations; IRAP-M: Contributions to Small Projects; IRAP-P: Contributions to Large Projects.

Institute for Manufacturing Technology: Ottawa
Ottawa, Ontario K1X 1X1
Contact: Not Available.
Personnel: Total is 9.
Activities: Not available

Institute for Marine Dynamics: Ottawa
Montreal Road, Building M-22, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 31.
Activities: Not available

Institute for Research in Optics
Ottawa, Ontario K1X 1X1
Contact: Not Available.
Personnel: Total is 19.
Activities: Not available

Institute for Research on Construction
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 341.
Activities: The Institute for Research on Construction of NRC was established in 1947, to provide a research service to the construction industry of Canada. It is organized on a multi-disciplinary basis to cover the subject areas of performance and properties of building materials and components, building services, energy, structures, noise, vibration, fire, geotechnical, building use and performance, and provision of technical information. The institute has major research facilities in Ottawa and regional laboratories in Saskatoon, Vancouver, Revelstoke and Halifax.
Facilities: In addition to well equipped laboratories, these facilities have specialized equipment developed specifically for building research, including furnaces for fire studies; large calorimeter boxes for determining the thermal performance of walls, windows, and other structural elements; and cold rooms for low temperature investigations.

National Aeronautical Establishment
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Total is 342.
Activities: As listed below.

Low Speed Areodynamics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including wind tunnel tests on aircraft, buildings, bridges, and other structures; wind energy conversion, fluid flow instrumentation, wake vortices and wing-body interactions and aerodynamics of wind turbines.

High Speed Aerodynamics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including wings and bodies in transonic flow; high-lift systems; viscous flows; buffet and flutter; and computational fluid dynamics. Conducts commercial aerodynamic investigations for aerospace industries and agencies.

Unsteady Aerodynamics Unit
Montreal Road, Ottawa, Ontario K1A 0R6
Contact: Not Available.
Personnel: Data not available.
Activities: Including oscillatory and rotary experiments; validity of equations for aircraft dynamics; techniques for trace vapour detection (i.e. from hazardous chemicals and illicit materials); and effects of meteorological conditions on pesticide spray applications; plus operates a fleet of 10 research aircraft; flight research including aircraft flight systems, flight mechanics, atmospheric studies, aircraft operational problems, navigation and guidence systems, agricultural and forestry aviation and aeromagnetics. This group provides assistance to the aerospace community in Canada in matters relating to design, fabrication and structural integrity of aircraft and space structures. In addition, the establishment maintains a Teleoperater Project Office which is responsible for the management of the Space Shuttle Remote Manipulator System (CANDARM) and for other related systems. The establishment also provides a focal point for all law enforcement projects carried out by the NRC for the RCMP as lead agency including laser fingerprint enhancement, radio spectrum space allocation, narcotics detection and evaluation of police equipment.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA

200 Kent Street, Ottawa, Ontario K1A 1H5
Contact: Ken Mintha, Head, Accounting Operations, Tel: (613) 995-5799
Personnel: Total is 138.
Activities: To promote and support the development and maintenance of research and the provision of highly qualified manpower in the natural sciences and engineering.

PUBLIC WORKS CANADA

Design and Construction Division
Riverside Drive, Ottawa, Ontario K1A 0M2
Contact: J.H. Davison, Acting Director, Science and Technology Development Directorate, Tel: (613) 998-8700
Personnel: Total is 145.
Activities: Technology, design and construction.
Facilities: Thermographic equipment; 1 AES C-20 system with 8 terminals; Testing equipment; Six Cymbol Cybernetic Workstations (5 based on the CA computer and one to use on DEC VAX); Three 7585B Hewlett-Packard E-size pen plotters.

TRANSPORT CANADA

Navigational Aids Test Establishment
Cardinal, Ontario K0E 1X1
Contact: J. Lorquet, Chief, Marine Aids, Tel: (613) 998-1384
Personnel: Total is 3.
Activities: A new Navigational Aids Test Establishment was constructed and officially opened on a ten acre site 90km south of Ottawa, at Cardinal, Ontario. The new buildings contain workshops and laboratories where the full range of conventional aids and associated equipment can be developmentally and qualificationally tested. Open air test pads around the main buildings

have been arranged for the testing of externally mounted equipment and complete power packages. NATE was previously located at Prescott, Ontario.

REGION L - CENTRAL ONTARIO

AGRICULTURE CANADA

Research Station: Vineland
Vineland, Ontario L0R 2E0
Contact: Dr. R.S. Menzies, Director, Tel: (416) 562-4113
Personnel: Total is 62.
Activities: The multidisciplinary, mission-oriented research program at Vineland includes the application of entomolgy, acarology, virology, mycology, nematology, residue chemistry and engineering to a variety of crops ranging from tree fruits, grapes, small fruits and vegetables to ornamentals, forage crops and tobacco. Pest management systems are being developed that employ a minimum of pesticide, yet permit effective pest control in fruit and vegetable crops. Methods of control for viral, fungal, and bacterial diseases through chemical and cultural means are being investigated.

ENVIRONMENT CANADA

Inland Waters Directorate - Ontario Region
867 Lakeshore Road, Burlington, Ontario L7R 4A6
Contact: E.T. Wagner, Director, Tel: (416) 637-4531
Personnel: Total is 89.
Activities: Water management, water data gathering, water investigations, socio-economic studies.
Facilities: Water sampling and measuring equipment; remote data transmission devices.

National Water Research Institute
867 Lakeshore Road, Burlington, Ontario L7R 4A6
Contact: James D. Smith, Chief, Staff Services, Tel: (416) 637-4656
Personnel: Total is 260.
Activities: Programs are conducted by 5 research divisions - Aquatic Ecology, Aquatic Physics and Systems, Analytical Methods, Environmental Contaminants, and Hydraulics and in the two regional units. NWRI is conducting studies that have drawn new subject-specific resources to the Institute in the areas of contaminants and eutrophication, contracting into the Hydraulics laboratory, long-range transport of airborne pollutants (including acid rain), aquatic impact of energy development, infestation by aquatic weeds, and investigations for the Great Lakes Water Quality Agreement.
Facilities: Standard and specialized laboratory and field equipment.

Wastewater Technology Centre
867 Lakeshore Road, Burlington, Ontario L7S 1A1
Contact: Mr. B. Jank, Assistant Director, Tel: (519) 637-4666
Personnel: Total is 50.
Activities: Evaluates, develops and demonstrates physical, chemical and biological processes for treating wastewaters, and treatment, reuse, and disposal technologies for wastewater residues and hazardous wastes.
Facilities: High-head pilot plant area; mobile wastewater treatment demonstration units; gas chromatograph; mass spectrometer.

Water Quality Laboratory
867 Lakeshore Road, Burlington, Ontario L7R 4A6
Contact: Dr. B.K. Afghan, Chief, Water Quality Laboratory, Tel: (416) 637-4661
Personnel: Total is 39.
Activities: The Water Quality Laboratory serves the needs of Environment Canada's ambient water quality monitoring program across Canada for complex analyses of environmental samples of water, sediment and biota.
Facilities: Inductively Coupled Argon Plasma Systems; High Resolution Gas Chromatography/Medium Resolution Mass Spectrometers; Automated Laboratory data management system based on VAX 11/75.

FISHERIES AND OCEANS

Bayfield Laboratory for Marine Science and Surveys
867 Lakeshore Road, Burlington, Ontario L7R 4A6
Contact: John Shaw, Regional Program Policy Officer, Tel: (416) 637-4522
Personnel: Total is 160.
Activities: The Bayfield Laboratory conducts hydrographic surveys for the production of navigational charts and related publications for the inland waters of Ontario and Manitoulin and marine waters of Hudson Bay region and central Arctic. Activities include hydrographic development, tides and water levels monitoring, chart compilation and cartographic development and survey electronics which includes research in sea ice classification radar.
Facilities: DATA COLLECTION AND PROCESSING: electronic positioning systems, optical, satellite positioning systems, echo sounders and sonar, radars, tide gauges and current meters, bubble-memory data loggers, digitizing tablets, plotters and graphics terminals, computer-assisted cartographic work stations, salinity profilers; COMMUNICATIONS: VHF, HF Radios, data collection platforms for satellite communications.

REGION M - METROPOLITAN TORONTO

ENVIRONMENT CANADA

Atmospheric Environmental Service: Headquarters
4905 Dufferin Street, Downsview, Ontario M3H 5T4
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 950.
Activities: Air quality and inter-environmental research, climatological services, ice services, meteorological standards, EDP services, meteorological stores, financial services, personnel services.
Facilities: Satellite receiving equipment; EDP equipment; Lab equipment; Radars; Airborne ice reconnaissance equipment (SLAR)

Atmospheric Environmental Service: Ontario Region
25 St. Clair Avenue East, 3rd Floor, Toronto, Ontario M4T 1M2
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 208.
Activities: Provision of meteorological services to the province of Ontario.
Facilities: Weather radar; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

Environmental Protection Service: Toronto
25 St. Clair Avenue, Toronto, Ontario M4T 1M2
Contact: D. Piersiak, Head, Financial and Administration Services, Tel: (613) 996-5840
Personnel: Total is 46.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.

HEALTH AND WELFARE CANADA

Civil Aviation Medicine Units Laboratories
P.O. Box 1035, Station B, Downsview, Ontario M3H 5V5
Contact: Dr. D. Elcombe, Chief, Tel: (416) 630-8503
Personnel: Total is 5.
Activities: Pathology research relating to Civil Aviation.
Facilities: Chemical analysis equipment.

NATIONAL DEFENCE

Canadian Forces Environmental Medical Establishment
P.O. Box 2000, Downsview, Ontario M3M 3B9
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 84.
Activities: CFEME is a military unit stationed with DCIEM. It does not perform research and development per se but works with DCIEM.

Defence and Civil Institute of Environmental Medicine
P.O. Box 2000, Downsview, Ontario M3M 3B9
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 161.
Activities: DCIEM, located on the Canadian Forces Base, Downsview, Ontario. The mission of DCIEM is to perform research and development to ensure the health and safety and effective utilization of man in any man-machine environment or in any adverse operational environment. The institute also conducts cooperative work with non-military government departments, with industry, and with universities. DCIEM is well equipped with modern facilities to simulate the various environments under study to perform human research in environments ranging from ocean depths, space, flight, to the arctic and the tropic.
Facilities: Portable Decompression Chamber; Atmospheric Diving System; Human Centrifuge; Precision Angular Mover.

Rehabilitation Technology Unit
P.O. Box 2000, Scarborough, Ontario M1W 3K5
Contact: Not Available.
Personnel: Total is 9.
Activities: Assists Canadian industry in the production of aids which are in low demand but of substantial benefit to disabled persons; develops models and subsequent improvements of aids for production by small manufacturers; assists TASH Inc., a marketing agency of the aids, with technical support; contracts with manufacturers for development and/or initial production of new or improved aids; develops consumer product adaptations or accessories to aid disabled persons.

NATIONAL RESEARCH COUNCIL CANADA

Technical Information Service: Toronto
789 Don Mills Road, Toronto, Ontario M3C 1T5
Contact: Not Available.
Personnel: Data not available.
Activities: Part of NRC's Field Advisory Service (see Industry Development Office - page XX).

REGION N - SOUTHWESTERN ONTARIO

AGRICULTURE CANADA

Animal Pathology Laboratory: Guelph
620 Gordon Street, Guelph, Ontario N1G 1Y4
Contact: Dr. T.R.S. Bhatia, Director, Tel: (519) 822-3300
Personnel: Total is 25.
Activities: Activities at this laboratory are mainly concentrated on diagnosis and research. Research is focused on meat microbiology, methodology development so that tests for diagnostic functions could be improved and implemented. Research is also being conducted on salmonella infection and contamination of livestock. In the salmonella research use of biotechnology (genetic engineering) is being exploited.

Research Station: Delhi
P.O. Box 186, Delhi, Ontario N4B 2W9
Contact: Dr. P.W. Johnson, Director, Tel: (519) 582-1950
Personnel: Total is 55.
Activities: This station is the primary centre for research on flue-cured tobacco in Canada. It is responsible for conducting research on the main problems associated with the production of high quality product to meet the requirements of export markets. Its research program features plant breeding and genetics, soil management and plant nutrition, plant physiology and biochemistry, insect and disease control, harvesting and curing methods, and those factors considered to be associated with tobacco and health. Alternative or rotational crops are being investigated for the sandy soil of the tobacco-growing area.

Research Station: Harrow
Harrow, Ontario N0R 1G0
Contact: Dr. C.F. Marks, Director, Tel: (519) 738-2251
Personnel: Total is 120.
Activities: The research station at Harrow serves southwestern Ontario, where favorable soils and climatic conditions permit an intensive and diversified agriculture. Interdisciplinary research is conducted in eight commodity-oriented programs designed to improve yield, quality, and efficiency of crop production. Crops under study include field and green-house vegetables, stone fruits, pome fruits, corn, soybeans, field beans, winter wheat, and burley tobacco. Crop improvements are achieved by the breeding of new varieties with superior characteristics and the development of improved crop, pest and soil management practices.

Research Station: London
University Sub Post Office, London, Ontario N6A 5B7
Contact: Dr. H.V. Morley, Director, Tel: (519) 679-4452
Personnel: Total is 82.
Activities: Research is directed towards the improvement of environmental quality and crop protection. Efforts are concentrated on integrated pest management programs (IPM) and environmental toxicology. IPM procedures, including methods of biological control, are being examined for the control of economically important pests. Studies of stored product insects include the development of resistance and the adoption of procedures leading to minimum pest residues. Natural plant disease resistant mechanisms are being studied for use in disease control. Chemical manipulation experiments are in process as well as selective breeding for resistant varieties. Studies are carried out on the efficiency of systematic fungicides and on fungicidal activity and resistance. Other important facets of the research program include the effect of pesticides on non-target organisms and the enviromental fate of pesticides.

REGION P - NORTHERN ONTARIO

Experimental Farm: Kapuskasing
Kapuskasing, Ontario P5N 2X9
Contact: Dr. J. Proulx, Superintendent, Tel: (705) 335-6148
Personnel: Total is 26.
Activities: The experimental farm at Kapuskasing conducts experiments on crop production and beef cattle management, in cooperation with the Animal Research Centre (Ottawa), for northwestern Québec and northeastern Ontario. The program emphasizes forage and cereal management, including maximum harvest times and optimum seeding rates.

Experimental Farm: Thunder Bay
P.O. Box 158, Postal Station F, Thunder Bay, Ontario P7C 4V8
Contact: Mr. J. Wilson, Superintendent, Tel: (807) 939-2523
Personnel: Total is 6.
Activities: The experimnetal farm at Thunder Bay is engaged in methods of crop production, particularly potatoes, for northwestern Ontario.

Forest Pest Management Institute
1219 Queen Street East, P.O. Box 490, Sault Ste. Marie, Ontario P6A 5M7
Contact: Dr. G. Green, Director, Tel: (705) 949-9461
Personnel: Total is 86.
Activities: The research and development program of the Forest Pest Management Institute is devoted exclusively to the development of efficacious and environmentally acceptable pest management strategies that will assist forest managers in the achievement of forest management objectives. The institute's research and development program is broad and complex. It includes the development of new or improved chemical insecticides and herbicides; biological control agents, such as bacteria, viruses, fungi and protozoa; and insect pheromones and growth regulators. A significant part of the program is concerned with development of equipment and technology for applying pest control materials accurately and effectively to the target of assessing the environmental impact of products and strategies developed and at elucidation of the persistence, dynamic cycling and ultimate fate of pesticides and their breakdown products in the environment. Research complimentary to the foregoing is concerned with cellular biology, immunology, tissue culture and systems analysis. In these areas, the Forest Pest Management Institute plays the lead role within the Canadian Forestry Service but works cooperatively with other Canadian Forestry Service regional forest research centres, provincial forestry agencies and other cooperators.
Facilities: The institute is well equipped with standard instrumentation to allow research to proceed in the foregoing fields. In addition to the basic equipment required for the above, the institute has an electron microscope, mass spectrophotometer, GC's, HPLC's, and other analytical equipment, spray chambers, a research spray aircraft, extensive insect, plant and pathogen production facilities and production and research greenhouses.

Great Lakes Forest Research Centre
1219 Queen Street East, P.O. Box 490, Sault Ste. Marie, Ontario P6A 5M7
Contact: Mr. J.H. Cayford, Regional Director, Tel: (705) 949-9461
Personnel: Total is 166.
Activities: The Great Lakes Forest Research Centre is one of six regional forestry centres operated by the Canadian Forestry Service. It is involved in a program of forest research and regional forestry development in Ontario, and provides the primary federal focus for forestry in Ontario. A large portion of the research program is concerned with long-term wood supply. Various forest renewal projects are under way, with emphasis on black spruce ecosystem silviculture and the mecanization of silviculture. Substantial efforts are also directed at the reduction of losses from insects, diseases and fire. A major cooperative project that involves other elements of Agriculture Canada as well as various provincial and federal agencies deals with the impact of long-range transport of air pollutants of forest ecosystems. The forestry development program is involved in negotiating and administering federal-provincial cost-sharing agreements with the province of Ontario, conducting economic studies, and implementing job creation programs in the forest sector.
Facilities: Gas Chromatograph; Atomic Absorption Spectrometers; Nitrogen Analyzer; Ion Chromatograph; Autoanalyzers; Freele Drier; Alkalinity Meter; Titroprocessor; Ph Meters; Conductivity Meter; Carbon Analyzer; Auto-Clave; Sterilizers; Nikon Photo-microagraph; Varian Universal Heaters; Oscilloscope; Portable Photosynthesis System; Sartorious Balances; Vax 750 Computer System and accessories; Microloggers.

ENERGY, MINES AND RESOURCES CANADA

Elliot Lake Laboratory
P.O. Box 100, Elliot Lake, Ontario P5A 2J8
Contact: R. Tervo, Director, Tel: (705) 848-2236
Personnel: Total is 26.
Activities: Rock mechanics and ground control in mines, underground environment - radiation, dust, ventilation and noise; mine tailings management.
Facilities: Four million pound capacity rock testing machine; Radiation calibration laboratory.

REGION R - MANITOBA

AGRICULTURE CANADA

Animal Pathology Laboratory: Winnipeg
408 Federal Building, 289 Main Street, Winnipeg, Manitoba R3C 1B2
Contact: Dr. R.C. Finlay, Director, Tel: (204) 949-2205
Personnel: Total is 9.
Activities: This laboratory is involved in diagnostic procedures in the fields of serology and bacteriology. The serology section is involved in Brucellosis and E.I.A. diagnosis while the bacteriology activities involve the diagnosis of contamination of meat and meat products and the identification of Salmonella and Campylobacter bacteria. The functions of the laboratory support the Livestock Industry and regulatory agencies.

Canadian Grain Commission - Grain Testing and Research
600-303 Main Street, Winnipeg, Manitoba R3G 3G8
Contact: N. Syzek, Budget Financial Analyst, Tel: (204) 949-2783
Personnel: Total is 97.
Activities: Provides technical advice on the end-use quality of Canadian grains and oilseeds in support of quality control and marketing of Canadian grain responsibilities.
Facilities: Grain pilot mill.

Research Station: Brandon
P.O. Box 610, Brandon, Manitoba R7A 5Z7
Contact: Dr. B.H. Sonntag, Director, Tel: (204) 728-7324
Personnel: Total is 81.
Activities: ANIMAL SCIENCE: Genetic breeding studies focus on utilization of crossbreeding to improve reproduction, feed lot performance and carcass quality of beef cattle. Reproduction physiology, endicrinology, nutrient requirements, feed utilization, genetics and management are areas of emphasis for improved productivity in swine. PLANT AND SOIL SCIENCE: Emphasis is on development of crop management systems for chernozemic soils of the eastern prairies through integrated fertilizer management, weed science, crop physiology and agronomy research with forages, corn, sorghum, wheat, barley, soybeans, and oilseed crops. In weed research surfactants and additives in herbicide solution are being studied for their effect on plant leaf membranes. In barley breeding the traditional techniques are used in malting and feed variety development. In corn breeding emphasis is placed on the selection of lines for cool season environments.

Research Station: Morden
P.O. Box 3001, Morden, Manitoba R0G 1J0
Contact: Dr. D.K. McBeath, Director, Tel: (204) 822-4471
Personnel: Total is 59.
Activities: A main centre of research on field crops such as buckwheat, field corn, field peas; oilseed crops such as flax, sunflower; horticultural crops, vegetables and small fruits; hardy ornamental species of shrubs and trees; and new crops. Programs include the production of new cultivars improved for yield, quality and disease resistance, mechanisms of rust-resistance in flax, methods of propagation of ornamentals, management practices, and weed control in crops.

Research Station: Winnipeg
195 Dafoe Road, Winnipeg, Manitoba R3T 2M9
Contact: Dr. T.G. Atkinson, Director, Tel: (204) 269-2100
Personnel: Total is 113.
Activities: The station is situated on the University of Manitoba Campus and maintains laboratory and greenhouse facilities. Research programs at Winnipeg can be broadly classified under three headings: development of improved cereal cultivars, protection of stored seed and seed products and integrated pest management of insect pests of fieldcrops. Research on the development of progressively superior cultivars of bread and durum wheat; development of barley and oats crops with improved agronomic and disease resistant characteristics. Quality testing and some disease screening services are provided to breeders at other establishments. Research on the storage and protection of grains, oilseeds and their products emphasizes ecology of storage; insecticide control and the detection, prevention and dynamics of mycotoxins in stored grains and oilseeds. Integrated control of agricultural pests is approached through damage assessment methodology, and increased knowledge of biology, parasitology, pathology and physiology of insect pests of cereal and oilseed crops.

ATOMIC ENERGY OF CANADA LIMITED

Whiteshell Nuclear Research Establishment
Pinawa, Manitoba R0E 1L0
Contact: Stephen Hall, Program Officer, Tel: (613) 236-6444
Personnel: Total is 1059.
Activities: Programs are mainly focussed on nuclear fuel waste management and on nuclear reactor safety research. WNRE directs the research on disposal of used fuel and fuel recycle wastes. This includes research on fuel waste immobilization, geotechnical research to develop methods of characterizing the rock formations that might host the disposal vault, the environmental and safety assessment to predict radionuclide migration from such disposal. The nuclear reactor safety program is intended to improve our understanding of nuclear reactor behavior under postulated loss-of-coolant accident conditions.

This includes research work on the thermalhydraulics of the reactor heat transport system, on the thermal-mechanical behavior of fuel and fuel channels, and on the containment atmosphere. Other work at WNRE includes fundamental investigations of the biological effect of radiation, and basic research in chemistry and materials science.
Facilities: RD-14 Thermalhydraulic Test Loop; Containment Test Facility; Underground Research Laboratory (under construction); Slowpoke Reactor (under construction).

ENVIRONMENT CANADA

Atmospheric Environmental Service: Central Region
266 Graham Avenue, Winnipeg, Manitoba R3C 3V4
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 253.
Activities: Provision of meteorological services to the provinces of Manitoba and Saskatchewan and the central portion of the Northwest Territories.
Facilities: Weather radar; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

FISHERIES AND OCEANS

Fisheries Development Division - Western Region
501 University Crescent - Freshwater Institute, Winnipeg, Manitoba R3T 2N6
Contact: Mr. S.K. Law, Director, Tel: (204) 949-5063
Personnel: Total is 6.
Activities: Conducts projects to more efficiently exploit fishery resources, explore and develop new fisheries, introduce and demonstrate new types of fishing vessels, equipment and techniques, develop new fishery products, improve the handling, processing and distribution of fishery products, conserve energy and provide technical support to industry.

Fisheries Research Branch - Western Region
501 University Crescent - Freshwater Institute, Winnipeg, Manitoba R3T 2N6
Contact: Dr. G.B. Ayles, Research Director, Tel: (204) 949-5268
Personnel: Total is 141.
Activities: Responsible for research relative to freshwater, freshwater fisheries, and Arctic marine fish and marine mammals. Fish habitat and limnological research emphasizes mechanisms and processes of biological production and decomposition in lakes, and includes studies related to energy development and use; in particular, acidification radionuclide and heavy metal pollution, hydroelectric reservoirs and toxic chemicals. Research in the development of the fisheries resource includes intensive aquaculture using waste heat, pilot fisheries enhancement studies of large lakes, stream rehabilitation, studies of fish diseases and fish product development. Arctic research emphasizes commercially important fish, marine mammals and associated ecosystems. Scientific disciplines at the Freshwater Institute include population biology, liminology, fisheries biology, organic and inorganic chemistry and toxicology, marine mammal biology, hydrology, and associated fields. Studies are carried out in laboratories at the Freshwater Institute and in the field stations located at varying latitudes ranging from north temperate to mid-Arctic (i.e. from 50 to 75 degrees north latitude).

NATIONAL RESEARCH COUNCIL CANADA

Canada Centre for Space Science: Gimli
Gimli, Manitoba R0C 1B0
Contact: Not Available.
Personnel: Total is 1.
Activities: The Mobile Scientific Balloon Launching Facility based at Gimli Airport some 90 km north of Winnipeg, launches high altitude balloons from several sites in Canada. The largest balloons launched have a volume of 570,000 m3 and can lift instrument payloads weighing some 1, 600 kg to altitudes of up to 40 km.

Institute for Manufacturing Technology: Winnipeg
Winnipeg, Manitoba R1X 1X1
Contact: Not Available.
Personnel: Total is 11.
Activities: This laboratory will work closely with industry and research organizations througout the country to ensure the development and transfer of appropriate computer and robotics technologies to industry.

Technical Information Service: Winnipeg
1329 Niakwa Road, Winnipeg, Manitoba R2J 3T4
Contact: Not Available.
Personnel: Data not available.
Activities: Part of NRC's Field Advisory Service (see Industry Development Office - page XX).

REGION S - SASKATCHEWAN

AGRICULTURE CANADA

Animal Pathology Laboratory: Saskatoon
116 Veterinary Road, Saskatoon, Saskatchewan S7N 2R3
Contact: Dr. W. Yates, Director, Tel: (306) 975-4071
Personnel: Total is 38.
Activities: This laboratory, which is located on the campus of the University of Saskatchewan, contains two sections; chemical residue analysis and infectious diseases. The chemical residue analysis section is concerned with diagnosis and research in the detection of potentially harmful chemical residues in meat and meat products. The infectious diseases section performs diagnostic and research activities on brucellosis and other diseases affecting domestic animals and also their interaction with wildlife species. Diciplines involved in these programs include chemistry, biochemistry, bacteriology, immunology and pathology.
Facilities: Mass Spectrometer; Atomic Absorption Spectrophotometer; Gas and high performance liquid chromatographs.

Experimental Farm: Indian Head
Indian Head, Saskatchewan S0G 2K0
Contact: Mr. M. Maw, Officer - in Charge, Tel: (306) 695-2274
Personnel: Total is 18.
Activities: The experimental farm at Indian Head has an excellent land resource for expanded work in agronomy and weed control of cereal, oilseed and other field crops. It is the only test site for southern Saskatchewan where field crop recommendations can be developed. Much of the work done here involves services to other research stations and includes evaluation of new lines and varieties of cereal, oilseed and other field crops (buckwheat, fababeans, field peas, lentils, canary seed).

Research Station: Melfort
P.O. Box 1240, Melfort, Saskatchewan S0E 1A4
Contact: Dr. S.E. Beacom, Director, Tel: (306) 752-2776
Personnel: Total is 48.
Activities: The major goals of the research station at Melfort are to provide the livestock producer, particularly feedlot operators, with an alternative to expensive feed grains, and to encourage the greater use of perennial forage crops in rotation to prevent further decline in the productive capacity of the soil. Research programs are directed to the improvement of forage systems to make them more economically competitive and to demonstrate that forage production is an integral part of food soil management. The cereal, oilseed and special crops program emphasize improvement of production efficiency with prevention of further soil deterioration.

Research Station: Regina
P.O. Box 440, Regina, Saskatchewan S4P 3A2
Contact: Dr. J. Dueck, Director, Tel: (306) 585-0255
Personnel: Total is 49.
Activities: A major centre for the biology and control of weeds in cultivated crops and pastures. High priority is given to the development of technology for biological control, using insects, plant pathogens and cultural means. The bio-control program includes projects on diffuse knapweed, leafy spurge, Canada thistle and sow thistle. The present necessity for weed control by herbicides in crop production requires sophisticated information on efficacy, crop tolerance, environmental persistance and health hazards. Studies of the environmental chemistry of herbicides include estimations of persistence in soils and residues in crops.

Research Station: Saskatoon
107 Science Crescent, Saskatoon, Saskatchewan S7N 0X6
Contact: Dr. J.R. Hay, Director, Tel: (306) 343-8214
Personnel: Total is 117.
Activities: There are four research programs with the following objectives: CEREALS; To improve management systems for cereal production in northwestern Saskatchewan, and to develop lines of barley and hard red spring wheat with resistance to common root rot for the prairies, and very high-yielding cultivars of utility wheat. OILSEEDS; To improve management systems for rapeseed/canola production in northwestern Saskatchewan, and mustard for the dark brown soil zones; to develop high-yielding cultivars of rapeseed/canola and mustard with improved chemical properties and good disease resistance, and to develop integrated methods for control of insects in oilseed crops. FORAGE CROPS; To develop hardy, disease resistant, bloat-safe alfalfa cultivars, and improved cultivars of selected grasses for Western Canada, and to develop integrated methods for control of insects in forage crops. INTEGRATED PEST MANAGEMENT; To develop integrated systems including biological, cultural and chemical means for control of weeds and insects, including grasshoppers, wireworms, and black flies, that will minimize our dependence on chemicals.

Research Station: Swift Current
P.O. Box 1030, Swift Current, Saskatchewan S9H 3X2
Contact: Dr. D. Bowden, Director, Tel: (306) 773-4621
Personnel: Total is 124.
Activities: Research takes a multidisciplinary approach to the production of high yields and disease resistance in cereal and forage crops. This is accomplished through research in plant breeding, plant physiology, agronomy, soil and water management, salinity control, nutrition, agrometeorology, and agricultural engineering. The station is a centre of expertise for energy production in the Prairie Region, and investigates methods of dual-fuelling, the use of wind energy, and geothermal energy for heating purposes. Assistance in the problem solving is provided at national and international levels.

ENVIRONMENT CANADA

Inland Waters Directorate - Western and Northern Region
1901 Victoria Avenue, Regina, Saskatchewan S4P 3R4
Contact: Dr. E.D. Ongley, Chief, Tel: (204) 949-5040
Personnel: Total is 219.
Activities: Providing information, advice and reccommendations related to water resource planning and management.
Facilities: KW 519-4-0086 for Disc drive, RA-60-CA 205 megabytes removable c/w cabinet and disc pack; KW 517-4-0178 for 1200 BAUD external Modem to connect Decwriter III to SaskComp Regional Computer Centre; KW 503-4-0193 for Epson FX-100 plus printer with cable for attachment to IBM/PC; Rixon R212A external 1200 BAUD Modem; KW 503-4-0186 Sedigraph Model 5000 ET for KW539.

Prairie Regional Station
1901 Victoria Avenue, Saskatoon, Saskatchewan S7N 0W0
Contact: Not Available.
Personnel: Total is 13.
Activities: The Prairie Regional Station is operated by NRC's Institute for Research on Construction (IRC) to provide technical information to the construction industry in the three Prairie Provinces for improved design, construction and operation of buildings and other structures. The station conducts research projects as a basis for its technical information services, and provides a communication link between the design professions, the construction agencies, the users of buildings, and NRC's Construction Research Centre in Ottawa.

NATIONAL RESEARCH COUNCIL CANADA

Plant Biotechnology Institute
110 Gymnasium Road, University Campus, Saskatoon, Saskatchewan S7N 0W9
Contact: Not Available.
Personnel: Total is 102.
Activities: The institute does research in plant-related industrial, forest, and agricultural biotechnology. It is primarily concerned with plants: the means in which they process molecules at the cellular level; how cells can be modified to generate substances of value, how crops can be utilized to optimize their value as food and animal feedstocks; ways of cultivating plant cells are studied, the production of disease free clones and the preservation of cells through continued freezing. Work with plants also includes photosynthesis, nitrogen fixation, and fungal degradation of forest products.
Facilities: The laboratory is equipped with greenhouses, environmental cabinets and environmental growth rooms for plants; chemical analytical equipment including gas and high-pressure liquid chromatographs, mass spectrometers, nuclear magnetic resonance instruments, other spectrometers - all computer-assisted; laboratory pilot scale units for crop processing and fermentation operations; in-house library, machine shop and data processing services; much other biochemical and biological equipment including facilities for summer field operations.

REGION T - ALBERTA

AGRICULTURE CANADA

Animal Diseases Research Institute: Lethbridge
P.O. Box 640, Lethbridge, Alberta T1J 3Z4
Contact: Dr. P. Stockdale, Director, Tel: (403) 381-8182
Personnel: Total is 54.
Activities: Research is mainly focused on respiratory, reproductive and neonatal problems in beef cattle with particular emphasis on the role and interaction of viruses, bacteria and mycoplasmas as well as the comparative relationships between management and disease in intensive and extensive production systems. Other research projects include studies on bovine herpes virus, leptospirosis, scrapie, clostridial diseases, and Arctic fox rabies. Disciplines involved are pathology, bacteriology, virology, immunology, clinical research. Diagnostic test service in these disciplines are also provided in support of federal disease control, eradication and certification programs in Western Canada.
Facilities: Large animal environmental chamber; Environmental Control Chamber; Millipore, Two-stage Filtration System; Micro-computer - two DEC Rainbow 100 (with peripherals); Camera, Photomicrographic, Orthoplan; Camera, Auto-F/Microscope, Reichart; Video Recorder and Monitor - with camera - RCA.

Experimental Farm: Fort Vermilion
Fort Vermilion, Alberta T0H 1N0
Contact: Mr. B. Siemens, Superintendent, Tel: (403) 927-3253
Personnel: Total is 10.
Activities: The experimental farm at Fort Vermilion is the most northerly component of Agriculture Canada's northern research group and, together with Beaverlodge, is historically and traditionally associated with frontier and development type of northern agriculture. Research activities include studies of the effect of climate on seeding dates, and fertilizer rates for cereal, oilseed and forage crops.

Northern Forest Research Centre
5320-122 Street, Edmonton, Alberta T6H 3S5
Contact: Mr. A.D. Kiil, Regional Director of Forestry, Tel: (403) 435-7210
Personnel: Total is 169.
Activities: Research into: 1) insect and disease management systems and surveys, 2) environmental impact of toxic substances and vegetation management, 3) wetlands and climate, 4) regeneration and plantation management, 5) nursery management and tree improvement, 6) stand productivity and forest inventory, 7) fire management systems, 8) forest hydrology, 9) resource economics.
Facilities: Inductively coupled plasma spectrometer.

Research Station: Beaverlodge
P.O. Box 29, Beaverlodge, Alberta T0H 0C0
Contact: Dr. J.D. McElgunn, Director, Tel: (403) 354-2212
Personnel: Total is 58.
Activities: Centre for research on northern agriculture covering response of crops to environment with emphasis on plant survival, micro-meteorology, weed control and plant pathology. Research on cereal and oilseed crops emphasized barley, wheat and rapeseed breeding and agronomy. Forage research concentrates on grass breeding, grass and legume seed management, and the production and utilization of forages. Soils research covers microbiology with emphasis on nitrogen fixation, organic matter relationships and crop management. Research in apiculture includes bee breeding, pathology and management.

Research Station: Lacombe
Lacombe, Alberta T0C 1S0
Contact: Dr. D.E. Waldern, Director, Tel: (403) 782-3316
Personnel: Total is 92.
Activities: The animal breeding section conducts research into methods of meat animal breeding, beef, cattle, and swine; major carcass evaluation and carcass grading programs. Studies of beef and pork quality in relation to pre-slaughter and post-slaughter conditions are assessed as factors in consumer acceptance.

Research Station: Lethbridge
Lethbridge, Alberta T1J 4B1
Contact: Dr. D.G. Dorrell, Director, Tel: (403) 327-4561
Personnel: Total is 299.
Activities: The station, located in a well-equipped Agriculture Centre built in 1976, includes space for visiting scientists. The facilities include a small animal vivarium of 29 controlled-environment isolation rooms, a phytotron with over 100 controlled-environment chambers and six greenhouses, and an electron microscopy laboratory. Comprehensive studies in basic and applied research related to agricultural production under rain-fed and irrigated regimes are conducted in multi-disciplinary programs in the following areas: Animal Parasitology, Animal Science, Crop Entomology, Plant Pathology, Plant Science, Soil Science. In addition to the 500-hectares at Lethbridge the station conducts research at a 20,000-hectare ranch and beef cattle breeding station near Manyberries, a 500-hectare ranch near Stavely and a 150-hectare irrigation substation at Vauxhall, Alberta.

Western Laboratory - Services Division
102-11th Avenue, S.E., Calgary, Alberta T2G 0X5
Contact: Adeline Peake, Acting Laboratory Director, Tel: (403) 292-5741
Personnel: Total is 33.
Activities: This laboratory provides physical, chemical and biological testing services in support of inspections, quality and safety assurance programs of the Food Protecion and Inspection Branch, on food products (meat, egg, dairy, fruit and vegetable products) and agricultural inputs (feeds, fertilizers, seeds and pesticides) for the western regions. Analytical methodology research is conducted in order to maintain state-of-the-art quality service on a timely and reliable basis.

ENERGY, MINES AND RESOURCES CANADA

Calgary Coal Research Laboratory
380, 4500-16 Avenue N.W., Calgary, Alberta T3B 0M6
Contact: M. Das, Assistant Manager, Tel: (403) 286-5512
Personnel: Total is 14.
Activities: The Calgary Coal Research Laboratory performs research in coal mining in the areas of underground ventilation and control of ground movement in Western Canadian mines. The laboratory is the focus of CANMET's national responsibility for coal reserve assessment as well as the centre for liaison with the Western coal mining industry. The general objective of the coal mining R&D effort is the achievement of improved health and safety in underground mining. Investigations are currently underway to correlate the adventitious production of explosive gases with the schedules of underground production in an hydraulic mine. This investigation is an expansion of previous work which led to the successful development of aerial surveying methods capable of identifying surface movements which responded to the underground production schedules at the same mine. The laboratory has also directed feasibility studies into the technical problems associated with the introduction of longwall mining into Western Canada which is, at present, restricted to the Maritime coal mines.
Facilities: Senturian 200 Mine Monitoring System.

Edmonton Coal Research Laboratory
P.O. Box 3294, Sherwood Park, Alberta T6A 2A6
Contact: Nels Andersen, Head, Fossil Fuel Science and Applications, Tel: (403) 987-8226
Personnel: Total is 24.
Activities: The Edmonton Coal Reseach Laboratory performs research in coal-cleaning and coal-washery waste clean-up, metallurgical coal processing for the production of blast-furnace coke, and the separation of bitumen-water emulsions produced during heavy-oil extraction processes. The objective of the coal cleaning and waste clean-up programs is to provide the coal industry with effective and economic technology for the removal of sulphur and ash so as to upgrade product quality to maintain and increase the Canadian share of the Pacific Rim market. The basic development of concepts is carried out in bench-scale experiments and developed into engineering design data using the 10 t/hr pilot scale coal cleaning plant. This pilot plant is unique in Canada and rare in the world and is frequently used in joint industry/government research programs. New facilities include a mobile pilot plant for the performance of on-site field experiments at both heavy-oil recovery and coal cleaning plant locations.
Facilities: Mobile Washplants (4 in all); 10 ton per hour pilot plant; 70 barrels per day emulsion treatment plant; analytical instruments - MNR spectromter, FTIR spectrometer, Laser Raman spectrometer, electro-phoretic mobility instrument.

Geological Survey of Canada - Institute for Sedimentary and Petroleum Geology
3303-33rd Street N.W., Calgary, Alberta T2L 2A7
Contact: M.A. Petre, Program Officer, Tel: (613) 995-4214
Personnel: Total is 154.
Activities: Geology of sedimentary basins of western and arctic Canada; structural geology and model studies, tectonics, geomathematical resource studies. Invertebrate paleontology, palynology, paleobotany, stratigraphy and sedimentology. Clay mineralogy, coal geology, petrolueum geology and organic geochemistry. Assessment of petroleum and coal resources, geochemical instrumentation; computer-based analyses of geochemical and hydrocarbon coal data.
Facilities: Computer capability for data storage and evaluation of petroleum, natural gas and coal resources; equipment for geochemistry, clay mineralogy, carbonates, paleontology, palynology labs, electronics shop, and machine shop; data processing equipment, cartographic and photographic equipment.

ENVIRONMENT CANADA

Atmospheric Environmental Service: Western Region
6325-103 Street, Argyle Centre, Edmonton, Alberta T6H 5H6
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 268.
Activities: Provision of meteorological services to the province of Alberta, the Yukon and the Western part of the Northwest Territories.

Facilities: Weather radar; Satellite receiving equipment; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

Canadian Wildlife Service - Western and Northern Region
4999-98 Avenue, Edmonton, Alberta T6B 2X3
Contact: R. Edwards, Assistant Chief, Tel: (403) 420-2525
Personnel: Total is 116.
Activities: Migratory birds conservation; wildlife research and conservation; wildlife management and administration.
Facilities: Satellite positioning radio transceiver; Sound specto; Terrestrial binoculars; Sound spectograph; Satellite scope; Depth sounder; Radio-collar tracking transceivers.

Environmental Protection Service: Edmonton
9942-108 Street, Edmonton, Alberta T5K 2J5
Contact: G. Klassen, Regional Finance Officer, Tel: (403) 420-2606
Personnel: Total is 80.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.

HEALTH AND WELFARE CANADA

Northern Medical Unit
12815-115th Avenue, Edmonton, Alberta T5M 3A4
Contact: Dr. O. Schaefer, Director, Tel: (403) 453-5311
Personnel: Total is 1.
Activities: Northern environmental research.

NATIONAL DEFENCE

Defence Research Establishment: Suffield
Ralston, Alberta T0J 2N0
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 186.
Activities: DRES, located at the CFB Suffield, Ralston, Alberta in addition to its laboratories has access to a secure serviced test area of about 1, 000 square miles and its programs have a large field testing component. DRES conducts basic and applied research on medical and chemical aspects of chemical defence, microbiology, chemical and biological defence training, aerial targets and RPV's, mine/countermine warfare, military engineering applications, vehicle mobility research and the disposal of hazardous and toxic materials.

REGION V - BRITISH COLUMBIA

AGRICULTURE CANADA

Animal Pathology Laboratory: Vancouver
13-3071 #5 Road, Richmond, British Columbia V6X 2T4
Contact: Dr. W.J. Dorward, Director, Tel: (604) 273-2713
Personnel: Total is 7.
Activities: The laboratory operates primarily as a diagnostic centre by providing serological, bacteriological and virological functions to support the livestock industry and branch program. Migratory waterfowl are also monitored for the presence of exotic viruses.

Experimental Farm: Prince George
R.R. #8, R.M.D. #6, Prince George, British Columbia V2N 2H8
Contact: Mr. W.L. Pringle, Superintendent, Tel: (604) 963-9632
Personnel: Total is 15.
Activities: Assists the Kamloops Research Station in servicing the diverse rangelands of interior British Columbia.

Pacific Forest Research Centre
506 West Burnside Road, Victoria, British Columbia V8Z 1M5
Contact: D.R. Macdonald, Regional Director, Tel: (604) 388-0600
Personnel: Total is 185.
Activities: The centre is engaged in basic and applied research in forestry, technology transfer, negotiation and administration of forestry agreements and job creation. Research activity is conducted in silviculture, tree physiology, soils hydrology, meterology, forest fire research, entomology, pathology, remote sensing, herbicides and biological control.
Facilities: Electron microscope; Image enhancement; VAX 750 computer.

Research Station: Agassiz
P.O. Box 1000, Agassiz, British Columbia V0M 1A0
Contact: Dr. J.E. Miltmore, Director, Tel: (604) 796-2221
Personnel: Total is 61.
Activities: ANIMAL SCIENCE - General nutrition and management of dairy cattle including development of grazing and cropping systems for intensive milk production; copper and selenium requirements of cattle and metabolic interactions with other feed constituents; deposition of yellow fat in pastured steers; nutrition and management of layers, broilers and broiler breeders with a view to minimizing feed costs and maximizing profits and product quality; nutrition and management studies on rabbits. CROP SCIENCE - Weed control, fertility, season extension and storage of vegetables; control of fruit rots and weeds in raspberry and strawberries as well as studies on soil fertility requirements of filberts and raspberries; management and physiology of silage corn; the management of ornamental and recreational turfgrass; and soil and water management of intensively cultivated wetland soils.

Research Station: Kamloops
3015 Ord Road, Kamloops, British Columbia V2B 8A9
Contact: Dr. J.A. Robertson, Director, Tel: (604) 376-5565
Personnel: Total is 29.
Activities: Specialist station for range management, range plant ecology and integrated resource management reseach. Also, cultivated forage crops, poisonous plants, winter feeding of cattle and rangeland soil fertility. Research is focussed on servicing the beef industry through development and transfer of technology on forage crops and beef production, as well as studies on bloat, poisonous plants, draught and winterhardiness.

Research Station: Sidney
8801 East Saanich Road, Sidney, British Columbia V8L 1H3
Contact: Dr. J. Molnar, Director, Tel: (604) 656-1173
Personnel: Total is 31.
Activities: The station has two responsibilities. First it is a research centre oriented to solving problems and giving direct service to the ornamentals and vegetable industries. Emphasis is placed upon plant nutritional and physiological problems and upon pest control in vegetables and ornamentals. Research on green house energy conservation is also done here. The second responsibility of the station is for the national post-entry quarantine program for Canada.

Research Station: Summerland
Summerland, British Columbia V0H 1Z0
Contact: Dr. G.C. Russell, Director, Tel: (604) 494-7711
Personnel: Total is 97.
Activities: Basic and applied research is conducted to solve problems concerned with the tree fruit and grape industries. The principal areas of research involving various scientific disciplines include: Entomology - Plant Pathology, Food Technology, Pomology and Viticulture, and Soil Science and Agriculture Engineering.

Research Station: Vancouver
6660 N.W. Marine Drive, Vancouver, British Columbia V6T 1X2
Contact: Dr. D.M. Weintraub, Director, Tel: (604) 224-4355
Personnel: Total is 59.
Activities: The principal centre for plant virus research. Areas of special interest include: physical and chemcial characteristics of plant virus particles, amino acid and nucleotide studies; response of plants to virus infecton and the mode of action of viruses;

plant virus inhibitors and virus multiplication; mixed infections and the resolution of complexes and separation of strains; host ranges and the characterization of plant virus diseases; serology, precipitin, complement fixation, ELISA; the use of biotechnology (monoclonal antibody production, complementary DNA) for plant virus diagnosis; meristem culture and virus-free clones; the morphology and fine structure of vectors; aphids and nematodes as vectors; the physiology of potato diseases. In addition, research is carried out on bacterial and fungal diseases, and integrated pest management in small fruit and vegetable crops, as well as an extensive program in small fruit breeding.

ENERGY, MINES AND RESOURCES CANADA

Geological Survey of Canada - Cordilleran Geology Division
100 West Pender Street, 6th Floor, Vancouver, British Columbia V6B 1R8
Contact: M.A. Petre, Program Officer, Tel: (613) 995-4214
Personnel: Total is 48.
Activities: CORDILLERAN GEOLOGY DIVISION: Geological problems of the Canadian Cordillera: structure, stratigraphy, sedimentology, paleontology, petrology, geochronology, regional syntheses, volcanology, geothermal studies and others. Metallogeny of the Canadian Cordillera. MARINE GEOLOGY SECTION OF CGD: Marine geology section is located at the Pacific Geoscience Centre. Geological studies of the Canadian Pacific continental margin: marine bedrock geology and geophysics including relevant onshore studies; stratigraphy, sedimentology, paleontology, structure, petrology, seismic, magnetics, regional syntheses, coastal geology, geology of estuaries, offshore surficial deposits, relevant geophysics.
Facilities: Marine geophysical and geological survey equipment, data processing equipment, equipment for paleontology labs.

Pacific Geoscience Centre
P.O. Box 6000, Sidney, British Columbia V8L 4B2
Contact: Dr. P.A. Camfield, Program Officer, Tel: (613) 996-4463
Personnel: Total is 27.
Activities: Geological studies of the Canadian Pacific continental margin: marine bedrock geology and geophysics including relevant onshore studies; stratigraphy, sedimentology, paleontology, structure, petrology, seismic, magnetics, regional syntheses, coastal geology, geology of estuaries, offshore surficial deposits, relevant geophysics. Electromagnetic induction in the crust. Engineering seismology studies. Tectonophysics. Strong motion theoretical studies. Application of gravity to geological problems, crustal and upper mantle structure and isostasy. Geothermal studies. Marine geophysics, including studies of polymetallic sulphides on the Jaun de Fuca Ridge.

ENVIRONMENT CANADA

Atmospheric Environmental Service: Pacific Region
900-1200 West 73rd Avenue, Bordigan Building, Vancouver, British Columbia V6P 6G5
Contact: E. Miller, Head Program Analysis, Estimates and Budget Branch, Tel: (416) 667-4911
Personnel: Total is 203.
Activities: Provision of meteorological services to the province of British Columbia.
Facilities: Satellite receiving equipment; Upper atmospheric measurement equipment; Automatic weather stations; Other meteorological equipment; EDP equipment.

Canadian Wildlife Service - Pacific and Yukon Region
P.O. Box 340, Delta, British Columbia V4K 3Y3
Contact: G. Kaiser, Acting Chief, Tel: (604) 666-0143
Personnel: Total is 38.
Activities: Migratory birds conservation; wildlife research and conservation; interpretation.
Facilities: Nightscope; IMS 8000 computer; Infrared thermometer.

Environmental Protection Service: Vancouver
Kapilano 100, Park Royal, Vancouver, British Columbia V7T 1A2
Contact: R.D. Stevens, Director, Program Planning and Administration, Tel: (604) 666-0048
Personnel: Total is 90.
Activities: The objectives of EPS is to ensure that human activities are conducted in a way that will achieve and maintain a state of the environment necessary for the health and well being of man, the health and diversity of species and of ecosystems and the sustained use of natural resources for social and economic benefit.
Facilities: GC Mass Spectograph; Gas Chromatographs; Atomic Absorption Units; Emission Spetrograph.

Inland Waters Directorate - Pacific and Yukon Region
502-1001 West Pender Street, Vancouver, British Columbia V6E 2M9
Contact: T.W. Foerster, Chief, Administration Branch, Tel: (604) 666-6252
Personnel: Total is 132.
Activities: To promote sound management and development of Canada's water resources in keeping with federal responsibilities and national objectives, including Canada-U.S. and Interjurisdictional Water Management, Flood Damage Reduction, Water Quality Management Data, Water Quantity Management Data, Water Management Research, Toxic Chemicals and Environmental Assessment and Baseline Studies.

FISHERIES AND OCEANS

Fisheries Research Branch - Pacific Region
Hammond Bay Road - P.O. Box 100, Nanaimo, British Columbia V9R 5K6
Contact: Dr. R. Beamish, Research Director, Tel: (604) 756-7040
Personnel: Total is 266.
Activities: Research studies are carried out on fin fish, invertebrate and marine mammal resources, and on their habitats, in support of the management, protection and enhancement of the resources of Canada's Pacific Coast, including the 200 mile economic zone. Programs include studies of developmental biology, life history, nutrition, parasites and diseases, behavior, physiology, endocrinology, genetics, ecology, population dynamics, stock assessments and abundance predictions. Programs on aquaculture, enhancement of salmon populations and effects of pollutants and physical disturbances (eg., forestry practices) are included. These research activities are based at the establishment above and at the West Vancouver Laboratory, 4160 Marine Drive, Vancouver, B.C., V7V 1N6.

Development Division
Hammond Bay Road - P.O. Box 100, Vancouver, British Columbia V6E 2P1
Contact: Mr. R. McIlwaine, Division Chief, Tel: (604) 544-2685
Personnel: Data not available.
Activities: Conducts research and development in four principal areas: (i) quality improvement (ii) cost reduction (efficiency/productivity improvement) (iii) commercial resource surveys/development of underutilized resources (iv) product development. Investigations are conducted on vessel design, harvesting gear design and operation, energy conservation measures, storage and transportation, product and processing research and development, and aquaculture. Present emphasis is on R&D support for the primary sector of the fishing industry.

Technology Services Division
Hammond Bay Road - P.O. Box 100, Vancouver, British Columbia V6T 1X2
Contact: Dr. H. Tsuyki, Division Chief, Tel: (604) 224-1366
Personnel: Data not available.
Activities: Research and development are carried out on all phases of fishery science and technology applicable to the primary fishing industry and consistent with Regional needs. Programs include: development of systematic technological database to assess quality of commercial species as affected by variations in season, sexual maturity and geographic area; engineering research to improve, modify or develop new systems of chilled and frozen storage and biochemical and food science research to assess the effects of these changes on the quality of commercial species; engineering studies to improve or develop pumping systems for vessel to vessel and vessel to shore fish transfer; investigations on chilled and frozen storage life extension; fish roe technology; microbiology of fish spoilage; studies on botulism; chemical assessment of marine plants for polysaccharide extractives; develop systems for live holding shellfish for quality improvement and for depuration of contaminants; technology transfer to the fishing industry.

Institute of Ocean Sciences
9860 West Saanich Road, Sidney, British Columbia V8L 4B2
Contact: Dr. C.R. Mann, Director General, OSS - Pacific Region, Tel: (604) 656-8215
Personnel: Total is 310.
Activities: The Institute of Ocean Sciences is a centre for oceanographic research and the provision of hydrographic services. Oceanographic research encompasses the fields of physics, chemistry and ecology and is focussed on the coastal waters of British Columbia, the north Pacific Ocean and the Western Canadian Arctic. The Hydrographic Service conducts field surveys to provide information in the form of charts, tide and current tables, sailing directions, etc. for the coastal waters of British Columbia, the western Arctic and the navigable fresh waters west of the Manitoba border. Coastal oceanography examines the processes of flushing and mixing, circulation and water transport on the coast and continental shelf. Studies in the channels and confined waters are related to biological productivity, transport and dispersion of pollutants and nutrients. Long term studies investigate the physical, chemical and biological parameters in the northeast Pacific and the variability of the circulation of the Alaskan gyre. Arctic oceanography is conducted in the Beaufort Sea, the waters of the Canadian Arctic archipelago and adjacent waters of the Arctic Ocean. Studies are concerned with the seasonal circulation of Arctic fjords and continental shelf; the dynamics of sea-ice; the processes of ice growth and decay and the air/ice/water energy budget. Theoretical studies, remote sensing and numerical modelling forms an integral part of the forgoing studies. Chemical oceanographic studies relate to trace heavy metals in the marine environment, hydrocarbon pollution and the global carbon dioxide budget. In the field of ecology plankton and benthic invertebrate distribution and ecology are studied in relation to production, physical forcing mechanisms, pollution and ocean dumping. Marine environmental data review and assessment, marine climatological data studies, data compilation and quality assessment are undertaken as part of an ocean information service.
Facilities: (i) Four large vessels ranging from 1600 to 97 gross tons and one large vessel on charter at 1378 gross tons. Two of these vessels are rated Ice Class I. One submersible at 5 gross tons and 27 launches and smaller vessels under 12 gross tons.

(ii) Sperry 1100/60 computer utilizing a Sperry DCP/20 front end communication processor which allows high speed computer graphics and protocol flow control to intelligent devices. Microcom 300/1200 bps modems are used. (iii) A water tunnel of overall length 10.5 metres has a laminar floe working section of 1.3 metres length amd 30 cm by 30 cm cross section. Flow speeds can be obtained within the range of 0 to 12 metres per second. Internal pressure can be adjusted to permit the lid of the working section to be removed exposing the free water surface.

NATIONAL DEFENCE

Defence Research Establishment: Pacific
FMO Victoria, Victoria, British Columbia V0S 1B0
Contact: Director, Research and Development Program Control, Tel: (613) 992-8440
Personnel: Total is 140.
Activities: DREP, located in Victoria, B.C. is concerned primarily with research related to the problems of anti-submarine detection in the North Pacific and in the Arctic Archipelago, including research in the areas of underwater acoustics, magnetics, and fluid dynamics, and with materials research.
Facilities: Research Vessel - CFAV Endeavour.

Western Laboratory
FMO Victoria, Vancouver, British Columbia V6R 1P5
Contact: Not Available.
Personnel: Total is 19.
Activities: The Laboratory is involved mainly with R&D for industry in the areas of tribology (friction, lubrication and wear); instrumentation and microprocessor development; the development of small-scale low cost mechanical equipment; and the industrial application of numerically controlled (NC) design and manufacturing methods.

NATIONAL RESEARCH COUNCIL CANADA

Dominion Astrophysical Observatory
5071 West Saanich Road, Victoria, British Columbia V8X 4M6
Contact: Not Available.
Personnel: Total is 50.
Activities: Maintains and operates, both as a national facility and for in-house research, an optical observatory for studies of the structure and evolution of galaxies; globular and open star clusters; binary stars with special emphasis on x-ray sources; super nova remnants; design of astronomical instrumentation.

Dominion Radio Astrophysical Observatory
P.O. Box 248, Penticton, British Columbia V2A 6K4
Contact: Not Available.
Personnel: Total is 28.
Activities: Maintains and operates both as a national facility and for in-house research on radio studies of the galaxy, super nova remnants, ionized hydrogen regions, pulsars, quasars and galaxies.
Facilities: 4-dish earth rotation synthesis telescope for neutral hydrogen spectroscopy and for continuum at 0.408 and 1.4 GHz; 25.6 # paraboloid with spectrometer and receivers for 0.408, 1.0, 1.4 and 2.7 GHz; long baseline interferometry; computing facilities; satellite terminal.

Rogers Pass Field Station
P.O. Box 248, Revelstoke, British Columbia V0E 2S0
Contact: Not Available.
Personnel: Total is 3.
Activities: As a part of its geotechnical work, IRC personnel study massive snow slides (avalanches) at Rogers Pass in the Rocky Mountains. The data gathered is used to design means of protecting roads, railways, and skiers from avalanches.

British Columbia Regional Station
P.O. Box 248, Vancouver, British Columbia V6R 1P5
Contact: Not Available.
Personnel: Total is 3.
Activities: Provides a link between the building industry in B.C. and the Institute for Research on Construction of NRC in Ottawa. Its major function is to provide an information service related to the technical aspects of building design, construction and performance.

REGION X - NORTHWEST TERRITOIRES

INDIAN AND NORTHERN AFFAIRS CANADA

Eastern Arctic Scientific Resource Centre
Igloolik, Northwest Territories X0A 0L0
Contact: Harald Finkler, Coordinator, Social Research and University Affairs, Tel: (613) 997-9666
Personnel: Total is 1.
Activities: The Scientific Resource Centre is used to support seasonal research and for continous research by four government departments. Current projects being undertaken include Seismology, Climatology, and Geomagnetism. Information collected is used by DIAND, DOE, DFO, and EMR.
Facilities: Includes a micro computer, basic instrumentation, as well as special equipment for data collection on air pollution, geomagnetic variation, climatology and seismology.